American Machinist

Volume 65 New York, October 28, 1926 Number 18

Getting the Most Out of Your Machine Tool Dollar

By Chester H. Franklin

I HAVE been much interested in the articles on Getting the Most Out of Your Machine Tool Dollar, by J. A. Smith, C. A. Shaffer, and others. They remind me of the method we use—they are so different.

We have a very simple method of determining when to buy a new machine. It does not require a formula nor any study of such high finance as interest on investment, depreciation, etc. And as for obsolescence, there isn't such a word in our dictionary.

When a machine breaks down—and cannot be repaired—we buy a new one. Or, in rare cases, where we get a contract with pieces so big that they will not go in the old machines, a new one is ordered. This method saves all kinds of mental calculation and much wear and tear on the gray matter.

We allow no depreciation on the machine equipment because we keep it up in A-1 repair at all times—at least on the books. And as long as you renew blades and handles of a jack knife often enough, you have a new knife. Of course, this isn't exactly the same as machine tools where new designs take heavier cuts and allow quicker handling, but it's a good argument, and sounds reasonable to the directors, who don't know a monkey wrench from a buzz saw anyway.

Our method of handling repairs is equally simple. When a machine breaks down so that the man on the job can't make it run even after a fashion, we call in the machine repair man, and forget it. Unless it is so far gone that it falls apart taking it up to the repair shop, he proceeds to rebuild it. There is no formality about it. What's the use of having clerks waste time and paper on a case like this?

Of course, the production end of the shop is shy a machine until it comes back and we may have to buy a new one if we can't pick one up second-hand at some junk shop. Then, too, we never know when the old machine will come back. The repair man hasn't any clerks either. But what's the use? We know when it comes back just as we knew when it went away, don't we? So why worry about the time you haven't got it?

Another advantage of not charging depreciation is that you always have a nice, fat looking figure for your machine equipment asset. It's especially useful when some official is trying to appraise the plant to see if you have overvalued it—before trying to sell it or issue more stock. Of course, it's a bit inconvenient about taxes at times, but you can't have everything your own way.

Obsolescence, as I said before, doesn't mean anything to us. It's a greatly overworked term and seems to have been devised by the builders of new machines to scare you into buying new equipment. Our machine tools almost never wear out. Take that old planer in the corner. It's been there at least 50 years, but it's still on the job. To be sure, some of the men don't like to run it—say they can't earn as much as some of the others do. One chap who tried to be funny said "he never was quite sure when the planer table got to the end of its stroke whether it would ever come back or just die where it was." But it's still running, and we've saved (?) the price of a new one, and they surely do ask real money for them nowadays.

The old man is always preaching economy to us and that new machines are extravagant as long as the old

The first nineteen articles in this series were descriptive of the best in equipment purchasing and maintenance practice. In publishing this twentieth, and last, article the intent is to show that there is another side to the picture and that the procession is a long distance behind the leaders. As a horrible example of how not to handle purchase and maintenance the shop described is ideal. Unfortunately, it is neither a small shop nor a fictitious one. It is large, old and well known. Take it as a warning, for its methods lead straight to the bankruptcy court

ones will run. It gets his goat to see the shop next door take contracts at a lower price than we can after spending thousands of dollars for new machinery that has to be paid for. He thinks they don't know how to figure overhead, with the cost of all the new machinery they buy, and that they must be losing money. But the funny part of it is, they made more money last year than we did.

When we need some special machine we make it. The cost goes into general expense and we don't know it. Of course, we put it on the books at full cost to help out the inventory. But we keep it out of the overhead so as to prevent running up the shop costs. Otherwise, we'd never be able to figure low enough to get a job.

Don't get the idea this is a small, one-horse shop, because it isn't. It employs several thousand men and isn't an imaginary plant, as you might think, just because the boss didn't want me to tell its name.

[With this article, the twentieth in the series, "Getting the Most Out of Your Machine Tool Dollar," that series is concluded. The first article by J. A. Smith, general superintendent of the General Electric Co., Schenectady, N. Y., was published on page 409, Vol. 62. The second by C. A. Shaffer, general supervisor of machinery and tools of the Illinois Central Railroad, was published on page 521, Vol. 62. The third, by Robert F. Runge, vice-president of SKF Industries, Inc., was published on page 719, Vol. 62. The fourth, by L. C. Morrow, managing editor, *American Machinist*, outlining the policies of the International Harvester Co., was published on page 793, Vol. 62. The fifth, by G. T. Christopher, factory manager, the Dayton Engineering Laboratories Co., was published on page 907, Vol. 62. The sixth, by D. C. Wright, of the H. W. Caldwell & Son Co. plant of the Link-Belt Co., was published on page 1, Vol. 63. The seventh, by T. C. Vail, superintendent, the Spicer Manufacturing Co., was published on page 175, Vol. 63. The eighth, by E. R. Norris, director of works equipment, the Westinghouse Electric and Manufacturing Co., was published on page 255, Vol. 63. The ninth, by Fred H. Colvin, editor, *American Machinist*, was published on page 417, Vol. 63. The tenth, by Wm. Bailey, production manager, the Hoover Co., was published on page 917, Vol. 63. The eleventh, by G. S. McKee, assistant factory manager, the Timken Roller Bearing Co., was published on page 995, Vol. 63. The twelfth, by Wm. Hartman, superintendent, the National Cash Register Co., was published on page 1, Vol. 64. The thirteenth, by Percy S. Brown, works manager, the Corona Typewriter Co., Inc., was published on page 183, Vol. 64. The fourteenth, by M. H. Westbrook, shop superintendent, Grand Trunk Railway System, was published on page 261, Vol. 64. The fifteenth, by Jerome R. George, vice-president, Morgan Construction Co., was published on page 381, Vol. 64. The sixteenth, by W. S. Graham, works manager, Hupp Motor Car Corporation, was published on page 697, Vol. 64. The seventeenth, by James E. Gleason, president and general manager, Gleason Works, was published on page 809, Vol. 64. The eighteenth, by R. A. DeVlieg, master mechanic, Chrysler Corporation, was published on page 929, Vol. 64. The nineteenth, by K. H. Condit, editor, *American Machinist*, was published on page 270, Vol. 65.]

Johnson Refuses to Buy a Pirate Machine

By John R. Godfrey

"YOU know, Godfrey, how I've taken sides with the machine tool men and tried to play fair with 'em when I wanted new equipment," said Old Man Johnson when I dropped in to see him last week. "I've even paid 'em for engineering work that they usually throw in as a chromo, whether you buy a pound of their tea or not. But I'm getting off 'em, Godfrey—why they don't even play fair with themselves.

"They build the master tools of industry all right, and we need 'em. But it isn't because of any master intellects—it's just an accident. If us motor builders didn't show more business sense than some of them do, we'd be in the poor house—and we ought to be."

So I asked for details and I got plenty.

"Well, I've had two doses this week, Godfrey. I was in the market for a milling machine, a little out of the ordinary and had about decided to buy another like the last when the boss of a little shop blew in and wanted the order. He quoted me a price that gave me a shock — and I'm glad no stockholders heard him. Because they'd swear I was throwing money away to pay a thousand dollars more for another machine. But that's what I'm going to do—and here's why.

"This bird told me frankly that he didn't build many millers. That his main work was contracting. But he had built some that people said were O.K. and that he could fill in his men's time and keep down his overhead by getting an order once in a while. Then, too, not having an agent in this district just at present, he offered me the agent's commission to boot.

"What I told him was plenty. You know, Godfrey, I've got a bit of Scotch in me and I don't fancy passing up a thousand bucks at all. I said, 'Look here, son, it ain't pleasant to tell you, but you're a plain business pirate. You do contract work mostly, sting a man when you can and lose money when you can't. Then you send a black flag expedition into the milling machine field to steal orders at a price that isn't fair to anybody—not even yourself. On top of that you offer me the agent's commission. Just suppose the next time I want a miller you have an agent here—then you ask more money for the same machine.

Don't Be a Copier

"Son, you've got this all wrong. When I buy a milling machine I want the best and most productive machine to be had. This means some builder must spend a lot of time and money developing new machines, new methods and new devices of all kinds. You can't do it, and if we depended on you it wouldn't be done. Every machine you sell makes it harder for the real builders to get along—and if many of us bought machinery from pirates like you the real builders would go out of business. And we'd be out of luck—because there would be no new developments. Don't be a copier, son, and don't be a pirate."

"But you can't blame the regular machine tool builders for men like him, Johnson," says I.

"Not entirely, Godfrey, but some of the so-called regulars have been known to shade things a bit. And even the regulars don't display the best judgment in the world. One of them brings out a very special machine. Takes a lot of time to design and build and work the bugs out of it. He sells one or two, at too low a price to cover his expenses. Then two or three others jump into the same game. They spend money on drawings and patterns and offer a similar machine to the world that is supposed to be waiting. When it comes to 'waiting' for machines of this kind, the world is right on the job. It's a darn good waiter.

"The man who builds the first machine of the kind is taking a long chance because it often happens that there isn't over a couple of dozen places in the country where such machines could pay for themselves. But the second man who starts in the game is a gambler and doubles the hazard of the first. It's bad enough to copy something that is in demand but to copy and put money into a machine when you can't possibly sell over a dozen all told, and at a price that doesn't leave any real margin, seems darn poor judgment to me.

"We need the machine tool industry—all other industry needs it. Couldn't get on without it. But I'm beginning to wonder if those of us who depend on it haven't got to get together and get a guardian appointed to keep it from committing suicide."

The Production of Variable Condensers for Radio Receivers

By Frank J. Oliver, Jr.
Editorial Staff, *American Machinist*

The unit mounting of three condensers in a Neutrodyne set necessitates precision in manufacture for good results—Press work on brackets—Soldering and finishing operations

THE Stromberg-Carlson Telephone Manufacturing Co. makes a 6-tube radio receiving set of the Neutrodyne type in which the three variable condensers for tuning the radio-frequency stages are mounted on a single shaft and are controlled by a single dial-knob. This construction simplifies station selection, since the only other control, besides the filament rheostats, is the antenna condenser, but it necessitates careful and accurate workmanship on the variable condensers to make them as nearly electrically and mechanically alike as is possible. Two such condensers often show a wide variation in dielectric capacity, although they may appear to have exactly the same physical dimensions. When the production is large, such as it is in this plant, matching is feasible to obtain a set of condensers of approximately the same capacity.

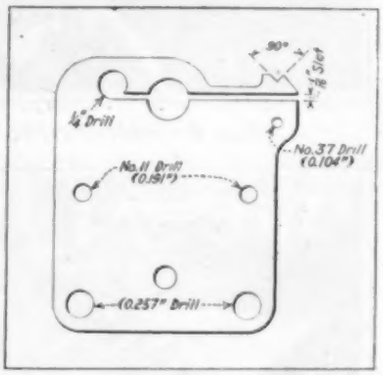


Fig. 1—Right condenser bracket

In Fig. 1, the right bracket or end frame of the condenser is shown. The tubular rotor shaft passes through the 0.368-in. drilled hole and the metal on the outside of the ⅛-in. slot is used as a spring brake. The fulcrum of the spring is at the ¼-in. drilled hole and the pressure is supplied against the 90-deg. notch by means of a set screw, which is held in a clip that is fastened to the bracket by means of a pin through the No. 37 drill hole. The clip pivots about this pin. A Bakelite bar that holds the stator plates assembly is riveted to the bracket through the No. 11 drill holes, while the two 0.257 in. holes in the lower portion are for use with separating studs that connect this bracket to the left one.

The left bracket is similar to the right except that two facing lugs about ⅜ in. apart are provided at a point opposite to and in line with the ⅛-in. slot. A set screw in each lug face provides close adjustment in locating the position of each stator unit with respect to the two others in line with it on the unit-control shaft. In other words both the stator and the rotor are supported from a single shaft and the former is prevented from rotating, when the shaft is turned, by means of these lugs that engage a fixed part of the assembly by means of set screws.

The brackets are punched from No. 10 B. & S. (0.012 in.) half-hard sheet brass, which is purchased in strips 5½ in. wide by 8 ft. long. Two press operations are involved. In the first one the piece is blanked and the eight holes are pierced in a No. 5 Toledo press. The strip is fed through the press by hand. The second press operation is performed in a No. 4 Toledo press illustrated in Fig. 2. Note the safety devices. Transparent shields swing between the operator and the die set when the punch descends. The operation is to shear the ⅛ in. slot, and the punch and die set used to accomplish this is shown in Fig. 3. In the illustration, the stripper plate has been drawn back to expose the thin-bladed punch. Ejection of the bracket is accomplished by depressing the hand lever on the front part of the die. It operates two stripper pins that bear against the bracket.

The brackets shown beside the die sets in Fig. 3 are the left ones and have additional material on one side for forming the two facing lugs in a subsequent operation. After the lugs are formed, the metal between them is slit with a saw in a milling machine to produce a spring effect and then each lug face is drilled and tapped.

After inspection, the brackets are cleaned in hot water, bright dipped, and nickel plated. The pieces are then washed and dried. Bakelite bars are fastend to the brackets with tubular rivets by means of a Stimpson riveting machine, after which the bracket assemblies are sent to parts stores.

Rotor and stator plate assemblies are shown at *A* and *B* respectively in Fig. 4. The plates are made of stretched sheet brass and are purchased stamped and ready for use. Lugs that overlap each other in a shingle effect when the plates are assembled are provided for use in soldering the plates together. Fixtures are employed for this operation that space the plates accurately with respect to each other. As a further precaution, all plates are first gaged for straightness and all bent ones are rejected. Fig. 5 shows an operator soldering the rotor plates together. Twenty plates are used and they must all drop freely in place in the fixture. The usual zinc chloride solution is employed as a flux for the solder, which is Reade's grade B in wire form. The flux is applied and the wire laid across the shingled lugs. It is then only the work of a few

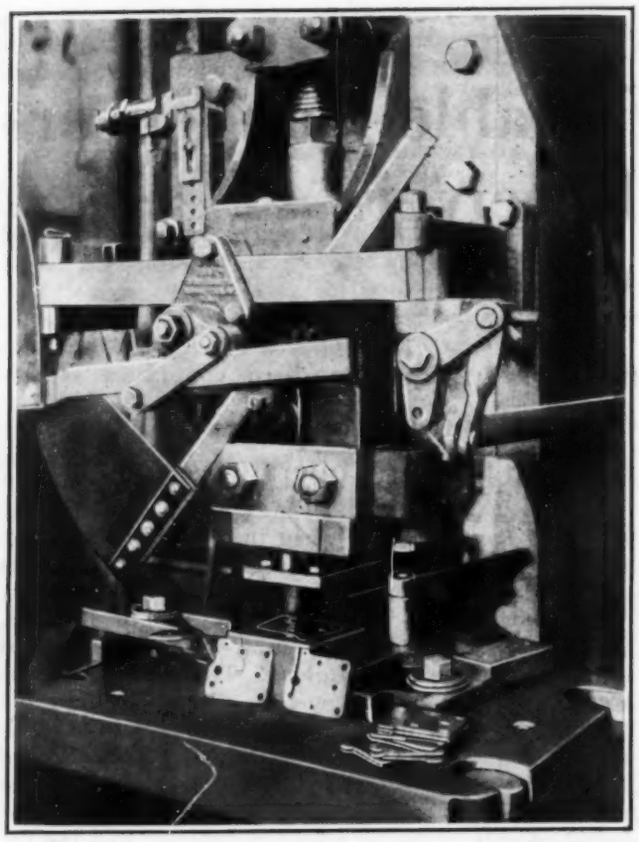


Fig. 2—Shearing slot in condenser bracket

seconds to touch the flat-head soldering iron, especially designed for this purpose, to the work and to obtain twenty neatly soldered joints. Electricity is used to heat the iron.

In Fig. 6, the operation of soldering the stator plates is shown. The form of the soldering iron and the plate holding fixture should be noted. Besides holding the plates together, the solder also attaches the brass rods, the threaded ends of which pass through the Bakelite bars attached to each end bracket.

After the plates have been soldered together, the assemblies are dipped in the following liquids: Oakite cleanser to remove all traces of the soldering flux, hot water to remove the Oakite, cyanide solution, hot water again to remove the cyanide, alcohol thinner to remove all traces of water, and finally Egyptian lacquer colored golden. The surplus lacquer is blown off by means of an air hose, and the plate assemblies are then hung on racks to dry. Fig. 7 shows the dipping tanks and drying racks.

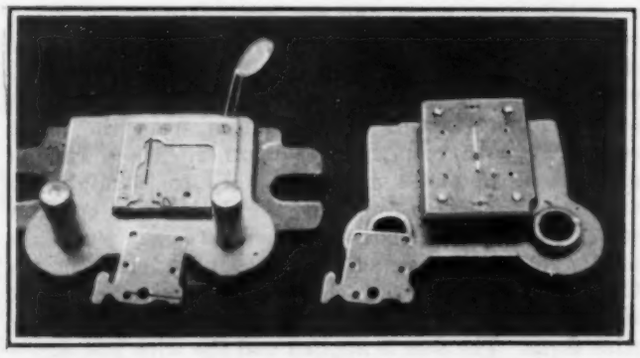


Fig. 3—Die set for shearing slot in bracket

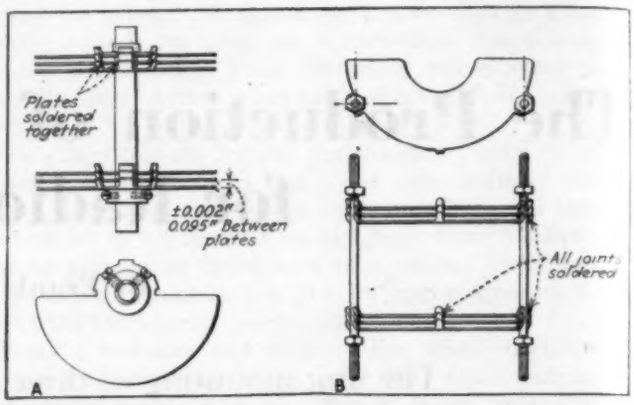


Fig. 4—Condenser rotor and stator plate assemblies

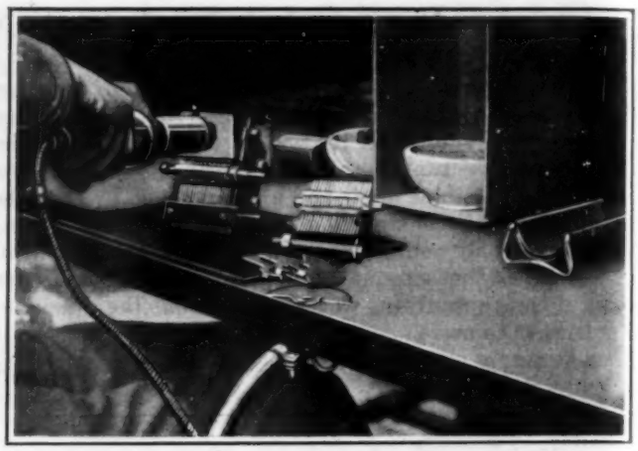


Fig. 5—Soldering the rotor plates

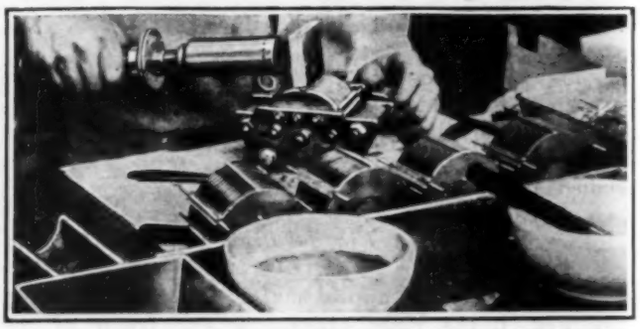


Fig. 6—Soldering the stator plates

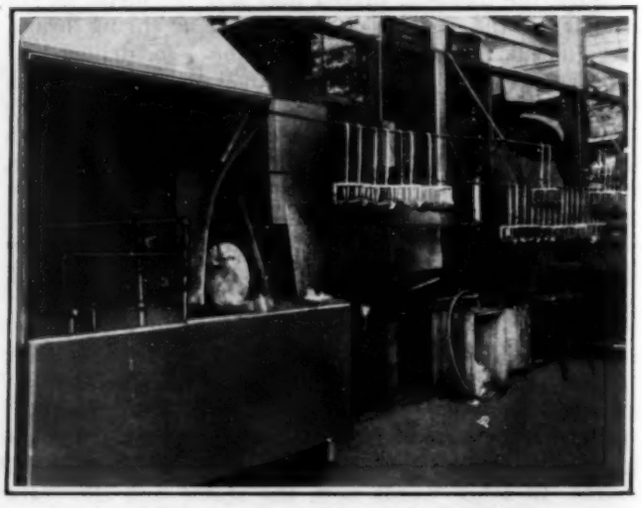


Fig. 7—Dipping tanks for plate assemblies

The stator plates are now ready for final assembly in the condenser unit. The rotor plate assembly, however, is placed in a bench lathe and the spool head is faced off. Then the rotor is reversed and the collar is faced with a hollow end mill. These finishing operations are quite essential for the correct functioning of the condensers. The end bearing surfaces must be at exactly 90 deg. to the shaft or else some axial movement will occur when the rotor is revolved that will upset the accuracy of the instrument.

The condenser may now be assembled as a unit. The rotor is slipped into the stator, the two end bracket assemblies are engaged with the rotor tube, and the separator studs are fastened in place. These studs, the stator rods, the rotor collar, set screws, nuts, and the like are all turned out in Brown & Sharpe automatic screw machines, of which this company has a battery of about fifty. The completed condenser is then connected to a slow moving shaft and run in while the next condenser is being assembled and adjusted. It is sent finally to the test bench where its capacity is determined in the maximum position. It is here that matching of condensers of approximately the same capacity takes place.

The Foreman's Power to Set Contract Costs

By Leslie Childs

THE question of an agent's power to bind his employer is usually one of fact, but where a person deals through an agent it is best for him to know the real extent of the latter's authority. This is important because a contract made with an agent, that is outside the scope of his authority, may not be enforceable against his employer.

The application of the principle to a manufacturing business is illustrated in a number of well reasoned cases, among them the case of an electrical supply company in Kentucky against a coal company.

In this case the coal company had its engine and generator damaged by fire, and requested the electrical supply company to send a certain foreman in its employ, named Daddysman, to look over the machinery and see what could be done in regard to repairs. This request for the foreman was by letter, in which the following language was used: "We want Daddysman to come and look it over and see what he can do for it."

The supply company telegraphed that Daddysman would be there on a certain date, and thereafter wrote a letter saying: "We are instructing Mr. Daddysman to examine carefully engine and generator, and advise you if practical to rebuild the same. If it is practical to rebuild the generator, we will guarantee the work to be O.K."

Accordingly Daddysman went to the coal company's place of business, examined the engine and generator, and stated that they could be repaired so as to be serviceable. In accordance with this advice, the coal company shipped the machinery to the supply company's plant where it was repaired.

The supply company rendered a bill for $1,900 for the work done. The coal company paid $1,200 of this bill, but declined to pay more on the ground that it had made a contract with Daddysman, at the time he examined the engine and generator, which provided that the cost should not exceed $1,200. The supply company thereupon brought action to recover the balance of $700 claimed to be due for the work done.

In the trial the coal company introduced evidence to the effect that Daddysman had assured them that the cost of repair would not exceed $1,000, and that he guaranteed the cost would not be over $1,200. The supply company, on the other hand, maintained in its evidence that Daddysman was not its agent with authority to bind it by a contract relative to the cost of the repairs.

In other words, the supply company took the position that Daddysman was simply its special agent for the specific purpose of examining the engine and generator, and advising whether or not it could be repaired profitably. On the evidence as outlined, the trial resulted in a judgment in favor of the coal company. The supply company appealed to the higher court, which reversed the judgment, and in passing upon the question of whether or not Daddysman had authority to bind his employer, in respect to the cost of the repairs, the Court, in part said:

Was Only the Agent

"The language of the letters is wholly inconsistent with any other purpose upon either side than that Daddysman was to go as an expert and advise whether or not the damage to their engine and generator was such that it could be repaired profitably. He was not an officer of appellant company but merely its foreman, and not only does the plaintiff's evidence show that he had no authority to fix the cost of the repairs, but the correspondence in evidence discloses unmistakably that his mission had nothing whatever to do with the cost of repairs.

"Appellant had him as its foreman, and appellee, knowing from previous experience with him that he was an expert about such matters, asked specifically that he be sent to 'look it over and see what he can do for it.' Being only a special agent, therefore, for a particular purpose, it necessarily follows that he had no authority to bind appellant in fixing the cost of the repairs."

The foregoing case constitutes an apt illustration of the importance of definite knowledge of an agent's authority, when it is sought to bind his employer by a contract entered into with him. For in the absence of such knowledge it is easy for two firms, both in the exercise of the best of faith, to become involved in a costly dispute over a situation initiated by an agent of one or the other.

Some shops have a plan that gives a bonus for service of five years or more and find it helpful in securing loyalty and decreasing labor turnover. In one such plant, and it employs nearly twenty thousand, half the men have been with them five years or over, twenty per cent, ten years or more and nearly five per cent are "quarter-century" men.

Book Reviews

Gears and Gear Cutting. Previously known as "Toothed Gearing," by Joseph Horner, revised and brought up to date by Philip Gates. One hundred thirty-nine, 5x7-in. pages, seventy-six illustrations, and ten tables, bound in cloth covers. Indexed. Published by Crosby Lockwood and Son, Stationers' Hall Court, Ludgate Hill, E.C. 4, England. Price 5s. net.

The author has endeavored to present a working knowledge of the theory, design, manufacture, and measurement of gears in as concise a form as possible. Under this limitation he has succeeded very well, and one can obtain from a brief study of the text all the high lights of these several phases of the subject. Obviously, a great amount of detailed discussion of fine points of theory or manufacture has been omitted, since the book has been written chiefly for the shopman. In the interests of economy of space and within the limitations of the purpose, such special gearing as pin, intermittent, and lobbed has also been omitted.

The nine chapters discuss, in order; principles, spur gearing, bevel gears, worms and worm wheels, helical gearing, spiral gears, skew bevels, the odontograph, and proportion of wheels. The illustrations, where made from photographs, are well selected.

Industrial Safety Organization. By Lewis A. DeBlois, S. B. Three hundred and twenty-eight 6x9-in. pages, with illustrations; cloth covers. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City, and 6-8 Bouverie St., London, England. Price $4.

"And the end is that the workman shall live to enjoy the fruits of his labor; that his mother shall have the comfort of his arm in her age; that his wife shall not be an untimely widow; that his children shall have a father, and that cripples and helpless wrecks that were once strong men shall not longer be a by-product of industry."

This quotation, chosen by the author to open his first chapter is a fitting introduction to a work that has for its purpose the setting forth of the principles upon which safety organizations are founded; the qualifications necessary to their personnel; the methods by which they attain their ends, and the splendid results that are accomplished by them.

Mr. DeBlois outlines the industrial accident situation and presents statistics compiled from records of well-known industrial organizations to show what has been accomplished by safety committees and safety promotion work in lessening the hazards of industry.

Entirely aside from the moral obligation to safeguard the life and limb of employees, these records show that organized safety programs pay big dividends in dollars and cents.

Condensed Catalogs of Mechanical Equipment. 16th Edition, 1927-28. Nine hundred and ten pages, 9x12 in. Leather bound, flexible covers. Published by the American Society of Mechanical Engineers, New York. Price $5.

The sixteenth annual volume is much the same as the preceding one with the exception that the information contained has been somewhat expanded. As usual, it is divided into three sections:

The Condensed Catalog Section, having a total of 638 pages of catalog data carried by 519 firms, giving uniformly presented and illustrated catalog information covering the products of manufacturers of various classes of mechanical equipment.

The General Classified Directory, a cross-indexed list of mechanical equipment with names and addresses of the manufacturers. There are 4,400 firms listed while the classifications of equipment number 6,000.

The Professional Engineering Service Directory, furnishing a classified list of the specialized lines of practice of members of the American Society of Mechanical Engineers, giving information describing the field and services of the 500 engineers listed.

There are over 3,200 illustrations and the Equipment Directory contains over 42,000 separate listings.

A new section, Part VI, has been added to the present volume, which is devoted to foundry, rolling mill and forge equipment.

This publication should prove of especial interest to mechanical engineers, engineer-executives and purchasing agents.

S. A. E. Handbook, September, 1926, revised and reprinted semi-annually, has recently been issued by the Society of Automotive Engineers, Inc., 29 West 39th St., New York, N. Y. Price to non-members $5. The book is 4x7 in., and is bound in flexible leather covers. It is completely indexed, and contains more than 600 standard and recommended practices. The contents are classified as follows: Power plant, lighting, electrical equipment, parts and fittings, iron and steel, non-ferrous metals, non-metallic materials, transmission, axles and wheels, tires and rims, frames and cranes, control, nomenclature, tests, body, and general. About thirty changes have been made over the previous issue.

Inclined Gothic Lettering, Lettering Exercise Manual (Industrial Edition). By Johathan Bright and John F. Faber. Thirty-four 8x5-in. pages, paper covers. Published by the Bruce Publishing Co., 354 Milwaukee St., Milwaukee, Wis. Price 28 cents. By means of two-color off-set printing, the exercise pages are so arranged that the student can trace over the light letters directly or reproduce whole letters or parts of them below or to the side of them. Faint horizontal guide lines are provided in every case, while slant guide lines are used only in the first part of the booklet. Emphasis is placed on capital letters, since many schools and drafting rooms use capitals only. Figures are also given. The exercises are planned to teach the spacing of letters and words, as well as their form.

Mittel zur Minderung des Kapitalbedarfs in den Betrieben. By Ernest Neuberg. Thirty-nine 6x9 in. pages. Paper covers. Published by Mundus Verlagsanstalt G. M. b. H., Charlottenburg, Germany. The booklet is a comparison between manufacturing methods used in Germany and the United States. The author believes that better conditions can be brought about in German industry by the adoption of American methods in finance, mechanical organization, and personnel. In his estimation, too much attention to detail and hand work is given by German manufacturers, while in comparison the American industrialist makes larger first-cost investments in automatic machinery, and elminates the excessive handling charges. He also cites how the American will abandon his profession to enter a more remunerative employment if necessary, while the German is permanently wedded to one idea of work.

Railway Tool Foremen Discuss Modern Methods

Fixture for drilling and milling key slots in piston rods — Device for timing valves — Repairing stoker racks—Gage used in planing crossheads

WHEN a group of toolroom foremen get together to discuss labor saving methods and devices, with a view of determining better methods of doing work, it is but natural for many new ideas to be brought out. Not the least of the benefits to be derived from such gatherings, is the interchange of ideas and experiences.

At the annual convention of the American Railway Tool Foremen's Association, held at Chicago Sept. 1 to 3, much discussion was brought out by the papers presented. Some of the tools described in the papers are shown in the accompanying illustrations.

A fixture for drilling and milling the key slots in piston rods is shown in Fig. 1. The rod is clamped in V-blocks at an angle equal to that of the key for drawing it into the crosshead. The V-blocks are an integral part of the slide *A*, mounted in dovetailed ways on the base *B*. First a hole is drilled through the rod, and then a helical cutter is inserted in place of the drill, as shown at *C*. Both ends of the cutter revolve in ball bearings. The key slot is milled from the solid metal by feeding the slide *A* toward the cutter. The length of the slot is governed by adjustable stops on the fixture.

The device illustrated in Fig. 2 is for revolving the driving wheels when setting the valves. The engine is jacked up and the device is placed in position. The engine is then lowered so that the driving wheels carrying the main crankpins bear against the rollers. Operation is by an electric motor, worm gearing being used to reduce the speed. The motor, mounted on a truck, can be seen in the background. Connection from the motor and the device is made by a shaft having universal joints.

A device for lapping the cylinders and pistons of automatic bell ringers is shown in Fig. 3. The crankshaft for operating the lap passes through the bearings at the top of the bell yoke, and is driven by an air motor attached to one end.

When the teeth of stoker racks are worn or broken, they are built up by welding. The built up teeth are finished by milling, as shown in Fig. 4, a multiple cutter being used. A rack that has been so repaired can be seen on the table of the milling machine.

The usual method of mounting a crosshead for planing the guide bearings, is to key it to its piston rod and clamp the rod in V-blocks, letting the crosshead overhang. In the operation shown in Fig. 5, the crosshead is mounted on a mandrel and the mandrel is clamped in V-blocks. The gage to be seen at *A* indi-

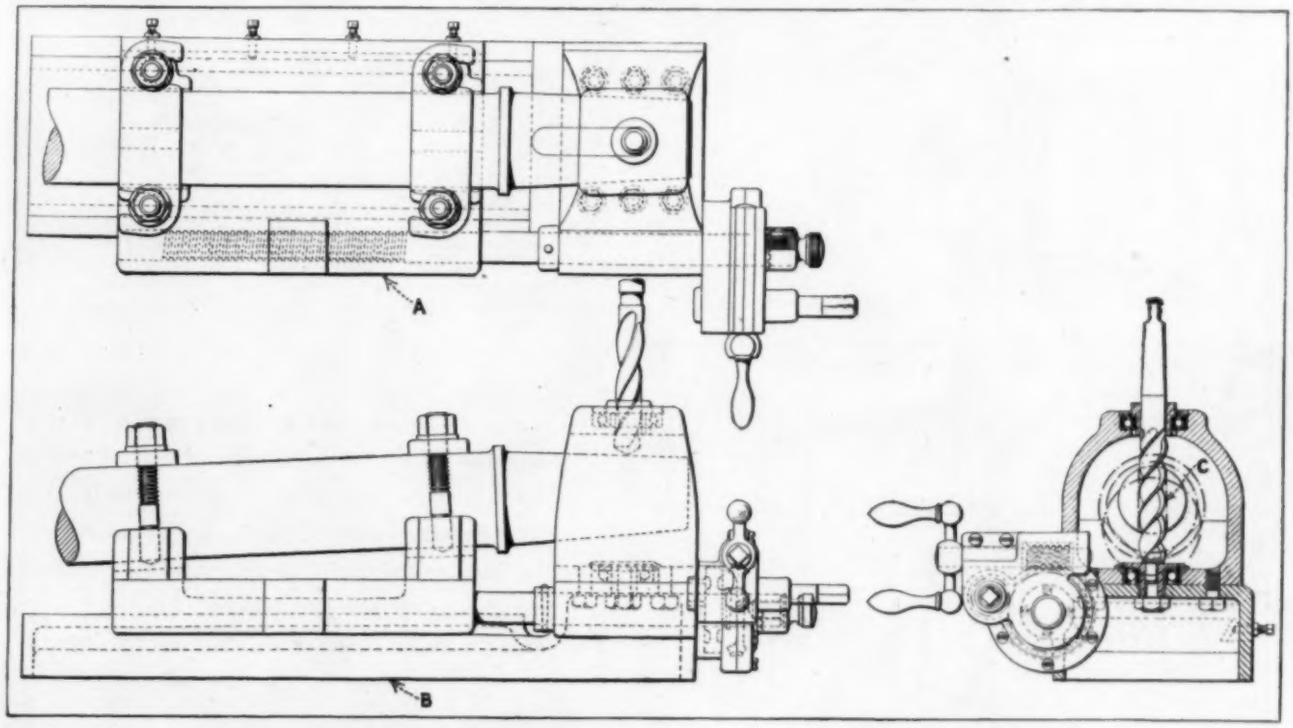
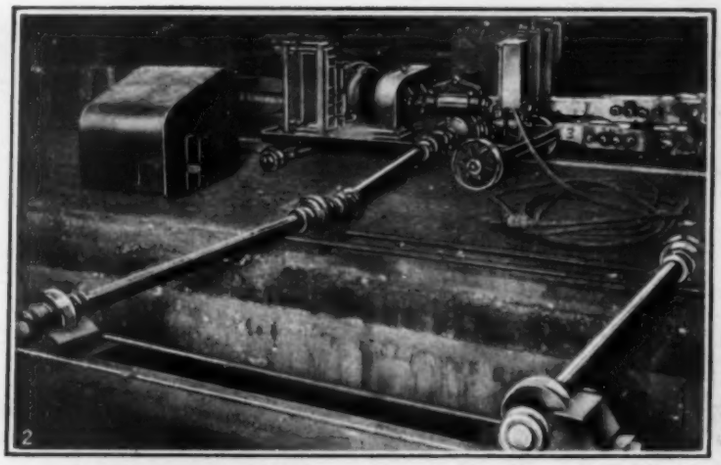
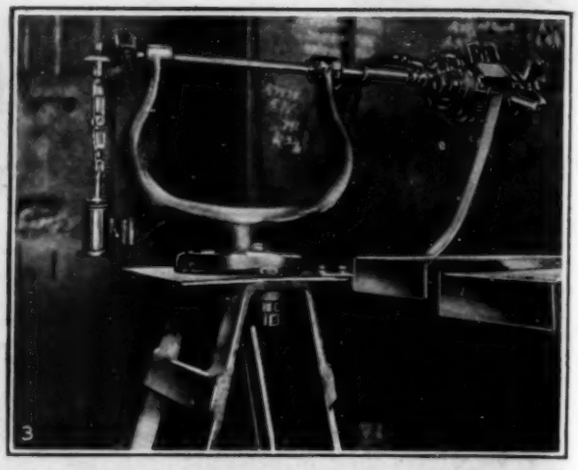
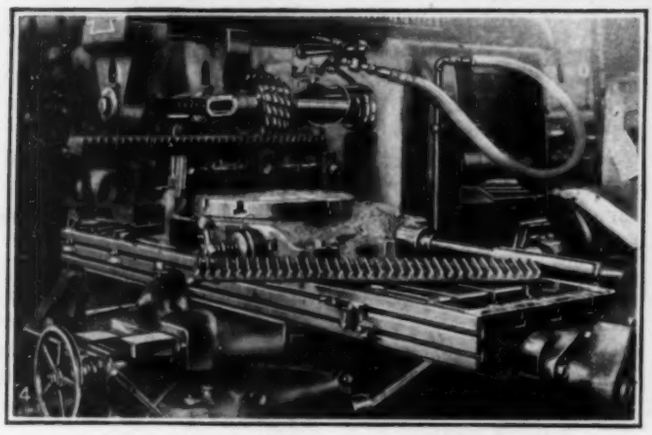
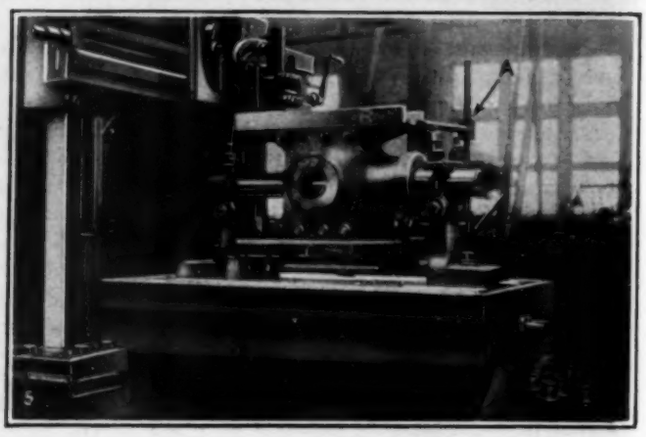


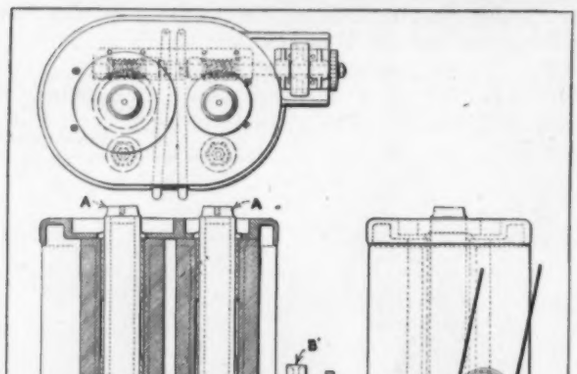
Fig. 1—Fixture for milling key slots in piston rods

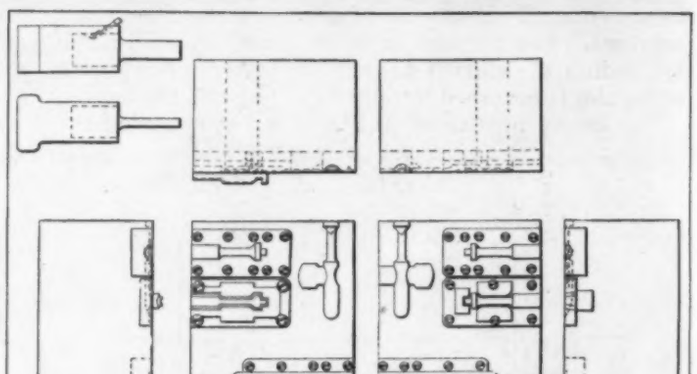












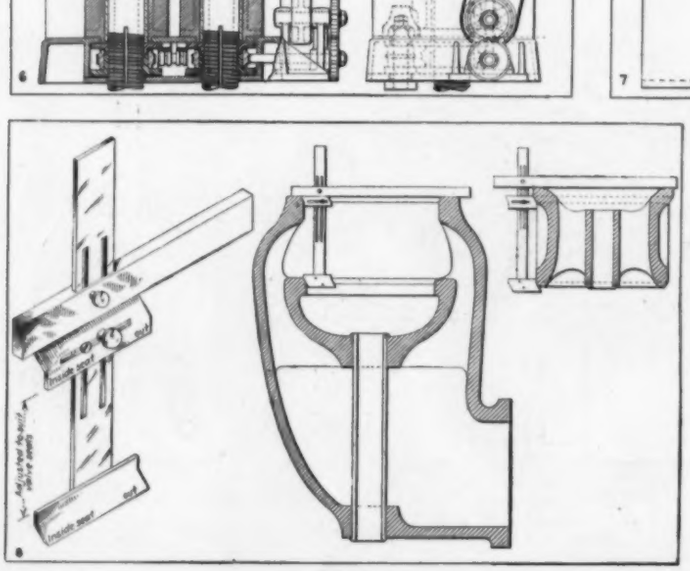


Fig. 2—Device used in setting valves. Fig. 3—Lapping device for cylinders and pistons of automatic bell ringers. Fig. 4—Milling teeth of repaired stoker-racks. Fig. 5—Crosshead mounted for planing the guide bearings. Fig. 6—Device for boring air-pump cylinders. Fig. 7—Forging dies for valve stems of cylinder cocks. Fig. 8—Gage for throttle valve

cates whether or not both sides are planed equidistant from the center.

Cylinders of air pumps are bored with tools of various types and in the majority of cases each cylinder is bored separately. To make sure of parallelism of the two bores in one section of the pump, and to reduce the time of boring, the device equipped with two boring bars, shown in Fig. 6, has been designed. The cutter heads are attached to the bars at *A*. The bars are belt driven through spur and worm gearing. The driving

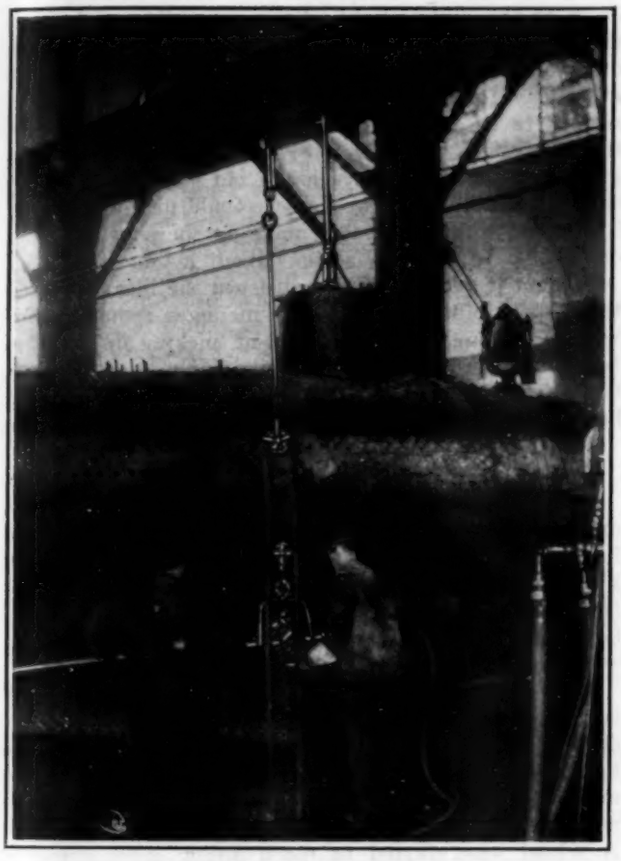


Fig. 9—A convenient jib crane

pulley can be seen at *B*. Clutches on the worm shaft make it possible to operate either bar independently, or both bars together.

A set of dies for forging the valve stems of cylinder cocks is shown in Fig. 7. The dies proper are inserted in die blocks and fastened with screws. Thus, any worn or broken die can be replaced by a new one without the necessity of making an entire new set.

A gage for throttle valves and standpipes is shown in Fig. 8. The view at the left is a perspective of the gage itself, showing its construction. The view in the center shows the application of the gage to a throttle standpipe, while the view at the right indicates the gaging of the valve seats transferred to the throttle valve.

A very convenient jib crane for handling such parts as springs, guides, cylinder heads, etc., is illustrated in Fig. 9. The crane can be attached to the dome, as shown, or to the smoke-stack opening. In the illustration it is being used to support an air motor engaged in tapping holes for staybolts.

Seen and Heard

By John R. Godfrey

Tolerances and Fits

MOST of us who have studied the subject of metal fits seem to have agreed that the "unilateral" or one-way tolerance has a number of advantages. One of these advantages is the possibility of using standard plugs and rings as "go" gages if the basic size is an even figure. And this is no small advantage when it comes to buying gages.

Most of us naturally expect that a workman, with a hole dimension of 2.00 in. + 0.001 —0.000 will aim to make the hole midway between the two or 2.0005 in. But right here is where some of my good friends in the shop tell me we are kidding ourselves. They say they don't do anything of the kind, at least not without several "knockdown and dragout" arguments—figuratively speaking, of course.

According to these good friends of mine the natural tendency of the average mechanic is to work to the dimension he sees written out in full—in other words the the basic dimension. The result is that they get more fits that are "too good"—that is so near basic that instead of having an allowance between the parts of the average fit, they are apt to be wringing fits—too tight for average use.

The obvious answer is to make a definite allowance and only use the basic dimension, such as 2 in. on *one* of the mating pieces. The basic dimension on the other piece can have the allowance so that if made maximum size, there is still room for as much freedom as may be necessary.

My shop friend, however, has the idea that the average shop man would come closer to getting what he wanted if he made his basic dimension so as to split the tolerance and use the old plus and minus system. With the dimension given splitting the tolerance, he feels that the average results might be better than they are now. This, however, eliminates using a standard gage.

On the other hand there are many disadvantages to this plan and I still believe the one way tolerance is better—even if we only use the nominal dimension as basic on one piece. We can then use one standard gage at least.

There is also a possibility of educating the worker to aim for the middle of the tolerances on both pieces and so avoid interference, even when using the nominal dimension as basic.

It's worth thinking over in any case—as are all gaging problems.

There is also another angle to the question of metal fits and one that is fortunately receiving more attention than was formerly the case. The same shop friend told me of several cases in his own plant where the designers had called for fits that were much closer than necessary. In fact, it was one of these fits that brought out the discussion as to unilateral tolerances.

The particular fit in question would have been perfectly satisfactory with five or even ten-thousandths clearance. But with the drawing only showing a thousandth on each part, as a maximum, the workmen naturally supposed it had to be a close fit.

Germany Laying Foundation for Future Industrialism

By O. Vogetzer

JUST as the materially biased see everything from the viewpoint peculiar to their kind, so the engineer views his environment in a manner characteristic to his kind. He is interested in progress and development, paying considerable attention to the laws of cause and effect. With this in mind I shall outline briefly some phases of the readjustment and the general trend in Germany today. The subject matter is derived from notes made during a recent visit to the industrial centers.

America can be proud of the fact that she is exerting a far reaching and incalculable influence upon German industry, and through industry upon the nation. American methods and achievements are being discussed everywhere with real animation and interest. But more important than that, the German mind in some mysterious way is vaguely, but none the less surely, beginning to apprehend something of American ideas and ideals as the following extracts from a lecture given to a gathering of prominent engineers and executives will tend to reveal.

"Our army was the most efficient organization the world over had seen; nevertheless that wonderful organization collapsed under the test because we forgot that a man, a human being, was in that uniform. Every year we used to assemble all males of military age, pick out the tall ones and send them to Berlin to the guards, the short ones to the provincial towns. Next we drilled and drilled them day after day until even the dullest of them knew the difference between right and left. But what about the man with brains and capacity for thought—how did he react to this treatment? Oh well, he is not supposed to think; all that is expected of him is to obey. That is the remark with which we dismissed the question."

Free Speech Practiced

When we consider that only a short time ago any man venturing to talk along those lines would have been sent to jail very quickly, we are forced to admit that real progress is under way. It seemed strange, too, to hear the following simple truths: "Nothing lasting can be accomplished in industry if the workers are dissatisfied." . . . "Remember that the worker plays an increasingly important part and we must accord to him his rightful place as a fellow being." . . . "We can become superior only by making our workers superior to any in the world."

I noticed that in several parts of the country, some really remarkable efforts are being made to train the next generation of machinists and toolmakers. They have begun to lay the foundations for an intelligent, self-governing people, free of hatred and prejudice, by teaching the young, giving them every opportunity to develop to the limit of their capacity.

Extensive and well worked out apprenticeship systems are already in operation. One large concern maintains a separate organization devoted entirely to the training of apprentices. The instructions also include such subjects as mathematics, physics and drawing. The institution is a self supporting unit complete within itself, having a separate bank account and separate books. The shop estimates on work submitted by the main works and if the price is right the order is placed.

At the end of each month a shop meeting is held during which, among other business, the standing of the "firm" is made known and discussed. If the books show a balance, every one of the apprentices feels very proud. One month there happened to be a deficit of several thousand dollars. The manager, pointing out the figures on the blackboard, asked what was to be done and told the boys that their business could not long continue under such conditions. Some youngster timidly suggested—"We must all try to use less waste and rags, cut down on the electric light wherever possible, and watch that no motors are allowed to run unnecessarily." Another one ventured—"Let's work a few hours overtime every day for a whole month without pay." A third seemed to be of the opinion that the following simple though drastic action would relieve the tense situation immediately: "There is a lot of old iron lying around the yards of the main works; we could pick up some of it and sell it, and probably make up the shortage very quickly." He was very serious about it too.

To sum it all up, the boys grasped the idea, they felt the responsibility. I heard the manager remark afterward: "Though the suggestion of 'picking up' old iron is morally wrong, it is, in my opinion, the best one because I would rather have the boys steal for their business than be indifferent to it."

Loyalty of the Workmen

During a certain phase of the Ruhr occupation, the executive of the apprentice shop, which was then in its infancy, was taken away and imprisoned. Upon his return after having been absent three months, to his great surprise he found everybody on the job. Those boys were loyal to such an extent that they voluntarily worked for three months without pay.

In order to give some idea how thoroughly this work is being started, I shall cite another instance. It was decided that giving the boys this training was only half the task. In order to complete the task some means of training and educating their future wives must also be devised. Action soon followed the word. A school was started to teach young girls domestic science, hygiene, child welfare, swimming, physical culture and many other useful subjects. This institution, like the rest is self supporting, the cooking class, for instance, doing the cooking for the apprentice casino; then there is a department for pressing and mending; another department where, for a small sum the children of parents who are both working may be left during certain hours of the day.

It appeared to me as if the point of having all such undertakings self supporting was being stressed beyond necessity, and I inquired whether it is purely for financial reasons, or if there are others. I was told that though money is scarce it is not the chief reason. The idea is that the individual should be conscious of working for what he gets, instead of being under the impression of receiving charity; and from actual observation I can say it has the desired moral effect.

I could cite additional examples of this preparatory work going on in Germany, but suffice it to state that the problem of developing the next generation is being dealt with in a highly scientific and efficient manner in several parts of the country, and one can not help but accord respect and admiration to the men and women devoting their energy to this cause.

Saving Money by Welding Jigs and Fixtures

By R. E. Kinkead
Engineer, Welder Division, The Lincoln Electric Co.

Both the time and expense of making patterns can be saved and cheaper material can be used in the body of the fixture

THE expense and time required to tool up for a new production job, or for a change in an established production job, may be substantially reduced by intelligent use of welding. From the simplest to the most complicated forms, jigs and fixtures are merely combinations of flats, rounds and shapes ordinarily rolled in structural steel. It is quicker and costs less to cut these pieces from standard steel stock and weld them together than to make a pattern and machine the piece out of a casting.

Some views of different jigs and fixtures, such as are used in the manufacture of Lincoln welders and motors, are shown.

Steel is the material used for all welded jigs and fixtures. Since steel is from four to five times as strong in tension and twice as stiff as is cast iron, it produces stronger and stiffer tools without excessive weight. Where the tools must be handled as a part of the production operation, weight is a matter of considerable importance.

Appearance of the tools is usually considered as a matter of secondary importance in high-speed productive operations. For this reason, hot-rolled steel is usually used as the raw material from which the pieces are to be cut. However, cold-rolled steel is frequently used for permanent tools on which a fine surface-finish is desirable.

Hard wearing-surfaces are easily provided on welded-steel fixtures and gages. The hard surface is obtained by welding a hard material on the soft-steel stock at the place at which it is needed. Stellite is frequently used for this purpose, although other metals such as 12 per cent manganese steel, are used to meet special conditions.

Warping due to the application of the welding heat does not offer any difficulties, since the welded unit is made up merely as a substitute for a rough casting. The subsequent machining operations bring the piece to specified dimensions.

In general, the cost of welded-steel tools in place of those made of castings is very low. The welded piece ready for machining costs on the average (based on an analysis of the costs on 119 pieces) one-third of the cost of the pattern that would be required to make the casting. As compared with the completed rough castings, the welded-steel pieces in the above analysis cost one-fifth as much. The large difference in cost is due, first to the elimination of the pattern cost, and second to the fact that hot-rolled steel costs about three cents a pound, cut to size, against from eight to ten cents per pound for castings suitable for toolroom work. Owing to the greater strength of the steel, considerable savings are effected by a reduction in weight.

There is undoubtedly a considerable money-saving attached to the use of welded-steel tools that cannot be directly estimated. It arises from the speed with which the tools can be delivered by the toolroom ready for work. This quicker delivery encourages department foremen to use fixtures without restriction where time savings may be effected by their use. Where it takes from three to four weeks, or longer, to get suitable fixtures, and there is an impending change, the general tendency is for the foreman to put off tooling up properly for the job. The fact that the welded tools are relatively inexpensive also contributes to the freedom with which department foremen will use them.

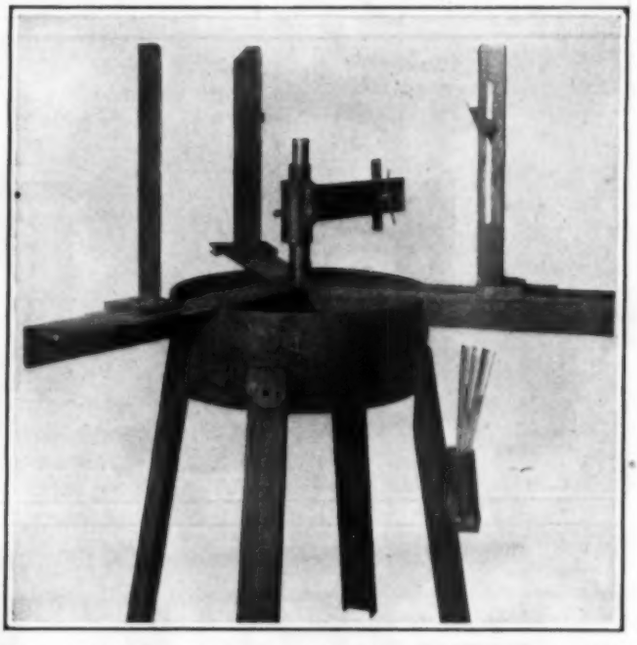


Fig. 1—Welded-steel assembly fixture. Weight 320 lb., cost $9.60. Estimated cost of patterns and casting to make same fixture, $85

Progressive toolroom foremen, by the use of welded steel in place of castings, are furnishing conclusive evidence that it does not "take months to get a job through the toolroom." Examples of welded jigs, tools and fixtures are shown on the next page.

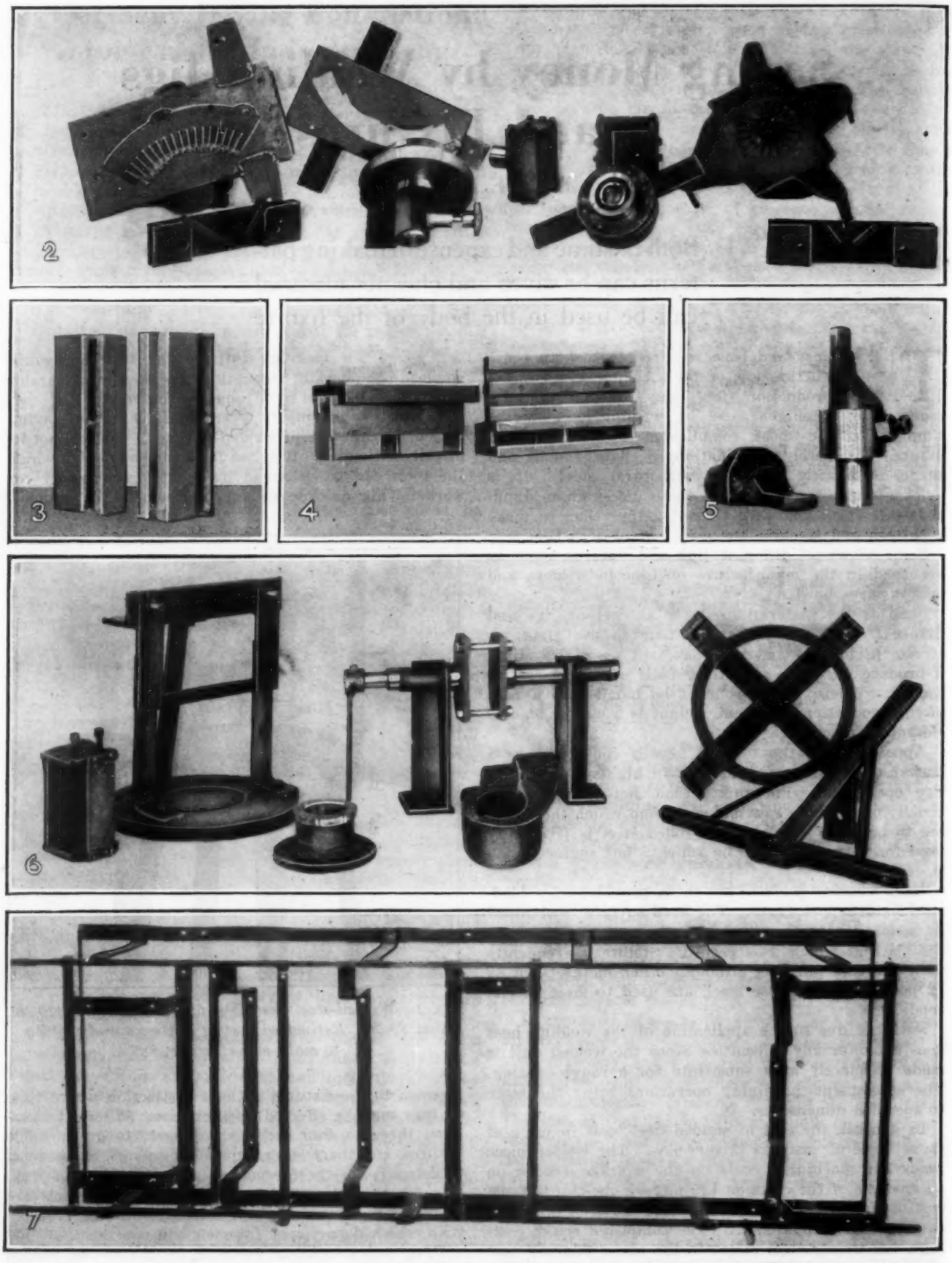


Fig. 2—Group of small tools made by welding. Fig. 3—Welded-steel pieces in the rough. Dies to form fiber insulation. Fig. 4—Same as Fig. 3 after machining operation had been completed. Fig. 5—Broken punches repaired in the toolroom by welding. Fig. 6—Small fixtures welded from standard hot-rolled steel sections. Fig. 7—Welded fixture for laying out holes in machine frame

Gear Teeth in Action

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Study of external planetary gear trains, continued—Velocity ratios, tooth loads, and power losses in internal planetary gear trains—Illustrative examples

WE WILL now examine the conditions that exist in a planetary reduction train when the sun gear F is larger than the sun gear S, so that the power is delivered in the opposite direction of rotation. In Fig. 16 a diagram of such a train is shown.

We already know that the reduction ratio for this type of planetary gear train is equal to $\left(1 - \frac{F \times Ps}{Pf \times S}\right)$. In this case, with F larger than S, the solution will give a minus value, which means that the driven gear S will revolve in the opposite direction to the driving member A.

As before, the action between these gears can be compared to a simple lever. In effect, the pitch point on the fixed sun gear F is the fulcrum, while the load is applied through the center of the planet pinions to force the moving sun gear S backwards. At the left in Fig. 16 is shown a diagram of a simple lever that represents these conditions. The force W_1 is the driving force, W_3 is the tangential tooth load on the driven sun gear S, while W_2 is the pressure against the fulcrum at the pitch point of the fixed sun gear F. As forces W_1 and W_3 are acting in the same direction, the pressure on the fulcrum W_2 is equal to their sum. We know that $W_1 \times m = W_3 \times n$, and $W_2 = W_1 + W_3$. We have from the diagram

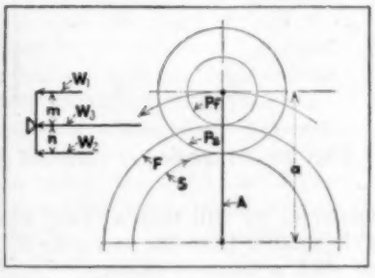


Fig. 16—Analysis of external planetary gear train

$$n = \frac{F - S}{2} \quad \text{and} \quad m = \frac{2a - F}{2}$$

$$W_3 = \frac{m}{n} W_1 = W_1 \left(\frac{2a - F}{F - S}\right)$$

When we know the amount of power to be transmitted and the speed we can readily determine the magnitude of the loads. When V = velocity in ft. per min. of point of application of driving force

$$V = \frac{2\pi a \times \text{r.p.m.}}{12} = 0.5236a \times \text{r.p.m.}$$

$$W_1 = \frac{33{,}000 \text{ hp.}}{a \times V} = \frac{63{,}025 \text{ hp.}}{a \times \text{r.p.m.}}$$

The sixth article. The seventh will appear in an early issue.

As a definite example, we will assume that a planetary gear train with the following values is to transmit 2 hp. when the driving shaft revolves 1,200 rev. per minute:

$F = 12.100$ in.
$S = 12.000$ in.
$Pf = 3.900$ in.
$Ps = 4.000$ in.
$a = 8.000$ in.

$$\text{Reduction ratio} = 1 - \frac{F \times Ps}{Pf \times S} = 1 - \frac{12.10 \times 4.00}{3.90 \times 12.00} = -\frac{4}{117}.$$

The driven shaft revolves, therefore, $1{,}200 \times 4/117 = 41$ r.p.m. in the opposite direction to that of the driving shaft. We have for the loads:

$$W_1 = \frac{63{,}025 \text{ hp.}}{a \times \text{r.p.m.}} = \frac{63{,}025 \times 2}{8 \times 1{,}200} = 13.13 \text{ lb.}$$

$$W_3 = W_1 \left(\frac{2a - F}{F - S}\right) = 13.13 \left(\frac{16.00 - 12.10}{12.10 - 12.00}\right) = 512.07 \text{ lb.}$$

$$W_2 = W_3 + W_1 = 525.20 \text{ lb.}$$

The pitch-line velocity of the sun gear S about its own axis is equal to $0.5236 \times 6.0 \times 41 = 129$ ft. per min. The pitch-line velocity of tooth engagement Ve that controls the power loss due to tooth friction is much higher than this, and must be determined in the same manner as before.

The pitch-line velocity Ve of the planet pinion Pf is equal to $0.5236 \times 6.05 \times 1{,}200 = 3{,}801$ ft. per min. The corresponding velocity of the planet pinion Ps is equal to $3{,}801 \times Ps/Pf = 3{,}899$ ft. per minute.

With a tooth load W_3 of 512.07 lb., the potential power transmitted by the second pair of gears is equal to $512.07 \times 3{,}899 = 1{,}996{,}561$ ft.-lb. per min. A power loss of one per cent here is equal to 19,966 ft.-lb. per minute.

The potential power transmitted by the sun gear F and its mating planet pinion is equal to $525.20 \times 3{,}801 = 1{,}996{,}285$ ft.-lb. per min. plus 19,966 ft.-lb. per min. The total is therefore 2,016,251 ft.-lb. per min. A one per cent power loss here is equal to 20,163 ft.-lb. per minute.

The total power loss due to gear tooth friction alone would amount to 40,139 ft.-lb. per min., or about 1.22 hp. when transmitting but 2 hp. A simple reduction train of three pairs giving the same reduction would have a power loss of about 0.06 hp. In this case also, the potential power transmitted by the gears in the planetary train is about thirty times as great as the actual power with a speed reduction of about thirty to one.

In the foregoing examples of planetary gear trains, the arm A has been the driving member, and the trains gave a reduction in speed to the driven member. If the arm A should be the driven member, with the sun gear S as the driving member, the speed ratio between the driver and driven would be unchanged, but the train would act as a speed increasing unit instead of a reduction unit. When transmitting the same power at the same speeds, the tooth loads and power losses would be practically the same regardless of whether the arm A was the driving or the driven member.

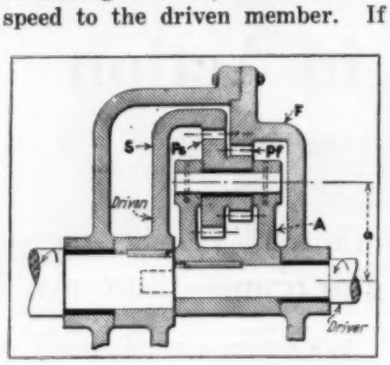


Fig. 17—Internal planetary gear train

In these examples only one pair of planetary pinions was used. Often two or more are used to reduce the unit pressures on the gear teeth and also to reduce the bearing loads. Thus, when a double set of planet pinions are used, the unit pressure, or pressure on the teeth of each pinion, is reduced to one-half of the total transmitted load, and the bearing pressures on the sun gear S and the main bearing of the arm A may be reduced to zero, but the total loads and power losses will remain unchanged.

Another type of a planetary gear train is one that employs two internal gears as sun gears. In Fig. 17, a planetary gear train of this type is shown.

We will first determine the reduction ratio of such a train in the same manner as before. In the construction shown, the arm A is the driving member and the internal sun gear S is the driven member. When all of the gears are locked together and revolved for one turn, both of the sun gears and the driven shaft will be advanced one turn. Then, when the arm A is held stationary and the fixed sun gear F is revolved backward one turn to restore it to its original position, the sun gear S will also turn backward an amount depending upon the ratio in the gear train between F and S considered as a simple train. This amount is equal to $\frac{F \times Ps}{Pf \times S}$. Whence,

$$\text{Reduction ratio} = 1 - \frac{F \times Ps}{Pf \times S}$$

This equation is the same as when two spur gears are used as sun gears. As before, when the solution is plus, the driven member will revolve in the same direction as the driving member: when the solution is minus, the driven member will revolve in the opposite direction to the driving member. In this construction, when the fixed sun gear F is smaller than the sun gear S, the final drive will be in the opposite direction to the original one, and when F is larger than S, both shafts will revolve in the same direction.

Here also, when the arm A is the driven member, the speed ratio of the planetary train will remain unchanged, but the unit will be a speed increasing unit instead of a speed reducing unit. The tooth loads and the power losses will also be approximately the same regardless of whether the arm A is the driving or the driven member.

As a definite example we will determine the reduction ratio of a planetary gear train as shown in Fig. 17 with the following values:

$F = 11.000$ in.
$S = 12.000$ in.
$Pf = 3.000$ in.
$Ps = 4.000$ in.
$a = 4.000$ in.

$$\text{Reduction ratio} = 1 - \frac{F \times Ps}{Pf \times S} = 1 - \frac{11 \times 4}{3 \times 12} = -\frac{2}{9}$$

If we reverse these values so that the fixed sun gear F is larger than the sun gear S, we would have the following:

$F = 12.000$ in.
$S = 11.000$ in.
$Pf = 4.000$ in.
$Ps = 3.000$ in.
$a = 4.000$ in.

$$\text{Reduction ratio} = 1 - \frac{12 \times 3}{4 \times 11} = +\frac{2}{11}$$

We will now consider the tooth loads on a planetary train of gears as shown in Fig. 17. As the first example, we will take a train where the fixed sun gear F is smaller than the sun gear S. In Fig. 18 a diagram of such a train is shown.

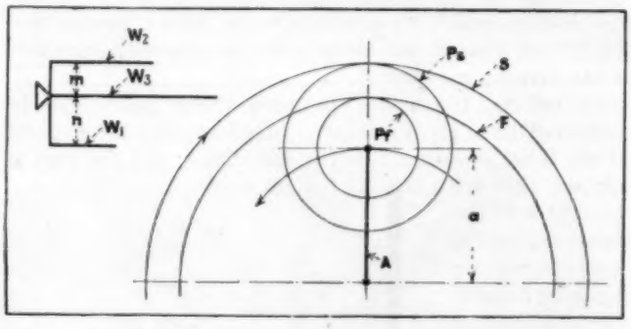


Fig. 18—Analysis of internal planetary gear train

As before, the action between these gears can be compared to a simple lever. In effect, the pitch point on the fixed sun gear F is the fulcrum. while the load is applied through the center of the planet pinions to force the sun gear S backward. At the left in Fig. 18 is shown a diagram that represents these conditions. The force W_1 is the driving force, W_2 is the tangential tooth load on the driven sun gear S, while W_3 is the pressure against the fulcrum at the pitch point of the fixed sun gear F. As forces W_1 and W_3 are acting in the same direction, the pressure on the fulcrum, or W_2, is equal to their sum. We know from the diagram that $W_1 \times n = W_2 \times m$, and $W_2 = W_1 + W_3$. We also have from the diagram

$$m = \frac{S - F}{2} \quad \text{and} \quad n = \left(\frac{F - 2a}{2}\right)$$

$$W_2 = \frac{n}{m} W_1 = W_1 \left(\frac{F - 2a}{S - F}\right)$$

When the power and speed requirements are known, these loads may be readily determined. When

V = velocity in ft. per min. of point of application of driving force

$$V = \frac{2\pi a \times \text{r.p.m.}}{12} = 0.5236 \times a \times \text{r.p.m.}$$

$$W_1 = \frac{33{,}000 \times \text{hp.}}{V} = \frac{63{,}025 \times \text{hp,}}{a \times \text{r.p.m.}}$$

As a definite example we will assume that a planetary gear train with the following values is to transmit 2 hp. when the driving shaft revolves 1,200 rev. per minute.

$F = 12.000$ in.
$S = 12.200$ in.
$Pf = 3.800$ in.
$Ps = 4.000$ in.
$a = 4.100$ in.

$$\text{Reduction ratio} = 1 - \frac{F \times Ps}{Pf \times S} = \frac{12.00 \times 4.00}{12.20 \times 3.80} = -\frac{41}{1,159}$$

The driven shaft will revolve, therefore, $1,200 \times 41/1,159 = 42.45$ r.p.m. in the opposite direction to the driving shaft.

$$W_1 = \frac{63,025 \times \text{hp.}}{a \times \text{r.p.m.}} = \frac{63,025 \times 2}{4.10 \times 1,200} = 25.62 \text{ lb.}$$

$$W_2 = W_1 \left(\frac{F - 2a}{S - F}\right) = 25.62 \left(\frac{12.00 - 8.20}{12.20 - 12.00}\right) = 486.78 \text{ lb.}$$

$$W_3 = W_1 + W_2 = 25.62 + 468.78 = 512.40 \text{ lb.}$$

The pitch-line velocity of the sun gear S about its own axis is equal to $0.5236 \times 6.10 \times 42.45 = 136$ ft. per min.

The pitch-line velocity of engagement of the planet pinion Pf is equal to $0.5236 \times 6.00 \times 1,200 = 3,770$ ft. per min.

The corresponding pitch-line velocity of the planet pinion Ps is equal to $3,770 \times \frac{Ps}{Pf} = 3,968$ ft. per min.

With a tooth load W_3 of 486.78 lb., the potential power transmitted between the sun gear S and its planet pinion is equal to $486.78 \times 3,968 = 1,931,543$ ft.-lb. per min. A power loss of one per cent due to tooth friction would amount to 19,315 ft.-lb. per min.

The pitch-line velocity of tooth engagement between the fixed sun gear F and its mating planet pinion Pf is equal to 3,770 ft. per min., while the tooth load W_3 is equal to 512.40 lb. The potential power transmitted by this pair is equal to $512.20 \times 3,770 = 1,931,748$ ft.-lb. per min. plus 19,315 ft.-lb. per min. The total potential power transmitted by this pair is therefore equal to 1,951,063 ft.-lb. per min. A power loss of one per cent here is equal to 19,511 ft.-lb. per min., and the total power loss due to tooth friction alone on this planetary train is equal to 38,826 ft.-lb. per min., or about 1.18 hp. when transmitting only 2 hp. In other words, it would require an input of about 3.2 hp. to deliver 2 hp. through this train. The power losses in this type of planetary reduction train are practically the same as for the first type studied.

As a second example of this type of planetary gear train, we will take one where the fixed sun gear F is larger than the moving sun gear S. In Fig. 19, a diagram of such a train is shown.

We already know that the reduction ratio for this type of planetary gear train is equal to $\left(1 - \frac{F \times Ps}{Pf \times S}\right)$. In this example, with F larger than S, the solution will be plus, which means that the driven gear S will revolve in the same direction as the driving arm A revolves.

As before, the action between these gears can be compared to a simple lever. At the right in Fig. 19 is shown a diagram of a simple lever that represents the tangential load conditions. The force W_1 is the driving force, W_2 is the tangential tooth load on the sun gear S, while W_3 is the tangential load on the teeth of the fixed sun gear F. Whence, $W_1 \times l = W_3 \times m$ and $W_3 = W_2 - W_1$. We have from the diagram

$$m = \frac{F - S}{2} \quad \text{and} \quad l = \frac{F - 2a}{2}$$

$$W_3 = \frac{l}{m} W_1 = W_1 \left(\frac{F - 2a}{F - S}\right)$$

As a definite example, we will take the following planetary gear train and determine the tooth loads and power losses when the arm A drives at 1,200 r.p.m., transmitting 2 horsepower:

$S = 12.000$ in. $\quad Ps = 3.800$ in.
$F = 12.200$ in. $\quad Pf = 4.000$ in.
$a = 4.100$ in.

$$\text{Reduction ratio} = 1 - \frac{F \times Ps}{Pf \times S}$$

$$= 1 - \frac{12.20 \times 3.80}{4.00 \times 12.00} = +\frac{41}{1,200}$$

The driven shaft will revolve, therefore, $1,200 \times 41/1,200 = 41$ r.p.m. in the same direction as the driving shaft.

$$W_1 = \frac{63,025 \text{ hp.}}{a \times \text{r.p.m.}} = \frac{63,025 \times 2}{4.10 \times 1,200} = 25.62 \text{ lb.}$$

$$W_2 = W_1 \left(\frac{F - 2a}{F - S}\right) = 25.62 \left(\frac{12.20 - 8.20}{12.20 - 12.00}\right) = 512.40 \text{ lb.}$$

$$W_3 = W_2 - W_1 = 512.40 - 25.62 = 486.78 \text{ lb.}$$

The pitch-line velocity of the sun gear S about its own axis is equal to $0.5236 \times 6.00 \times 41 = 129$ ft. per min.

The pitch-line velocity of tooth engagement of the planet pinion Pf is equal to $0.5236 \times 6.10 \times 1,200 = 3,833$ ft. per min.

The corresponding pitch-line velocity of the planet pinion Ps is equal to $3,833 \frac{Ps}{Pf} = 3,641$ ft. per min.

With a tooth load W_3 of 512.40 lb., the potential power transmitted by the sun gear S is equal to $512.40 \times 3,641 = 1,865,648$ ft.-lb. per min. A power loss of one per cent due to tooth friction would amount to 18,656 ft.-lb. per min.

With a tooth load W_3 of 486.78 lb., the potential power transmitted through the sun gear F and its planet pinion Pf is equal to $486.78 \times 3,833 = 1,865,828$ ft.-lb. per min. plus 18,656 ft.-lb. per min. The total potential power transmitted here is therefore equal to 1,884,484 ft.-lb. per min. A power loss of one per cent here would amount to 18,845 ft.-lb. per min., and the total power loss for this drive would equal 37,501 ft.-lb. per min., or about 1.14 hp. This would require an input of 3.14 hp. to deliver 2 hp. to the driven shaft.

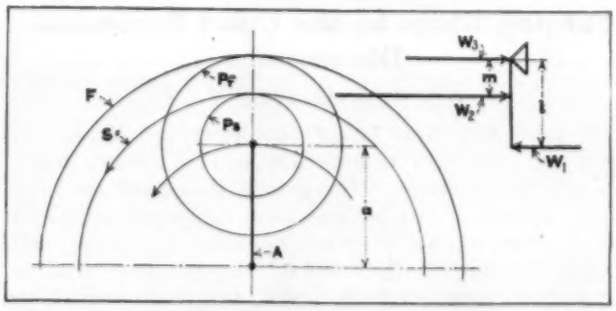


Fig. 19—Analysis of internal planetary gear train, where F is larger than S

Hardening-Room Practice—Discussion

By John J. Kauffman

Referring to the article by E. P. Barfield, under the title given above, and published on page 365, Vol. 65, of the *American Machinist*, I believe Mr. Barfield was misled by my original article, probably because I was not specific enough on the point in dispute.

The electric furnaces with recording pyrometers mentioned in my article, are Leeds & Northrup furnaces with L. & N. recording pyrometers. The combination is known as the "Hump Method."

These recorders produce a chart showing the rate of heating, the length of time the work has been in the furnace, and record the transformation of the steel from start to finish, or as Mr. Barfield puts it, from pearlite to austenite.

The principle here involved is, that the work on entering the critical stage absorbs the heat fed to the furnace without itself maintaining its rate of heating. In other words, the furnace keeps on getting hotter while the work lags behind during the transformation, because this energy is used up by the steel in changing from pearlite to austenite. Since the thermocouple is in direct contact with the work, it records only the temperature rise of the work itself.

Thus it will be seen that as the work enters the critical stage, the line on the chart deviates from its course, producing a rather pronounced curve or "hump" which ends and resumes its course as the work passes through the critical stage and returns to its former rate of heating, thus showing not only the temperature at all times, but the exact moment when the transformation is complete.

I maintain, however, that to much exceed the old rule of one hour per inch of cross section is not good practice, since the rate of heat absorption of a large piece of steel is fixed and should not be hurried. The outside, and especially the corners, will be considerably hotter than the inside, and to quench in this condition is inviting trouble.

I feel that a description of the "Electro Magnetic" method of hardening, by Mr. Barfield or someone else acquainted with it, would be in order and would help to throw more light on the question of tool hardening.

Forging Rings by the Upset Process—Discussion

By Karl Bell

On page 949, Vol. 64, of the *American Machinist*, there was published an article by J. C. Kielman, under the title given above. The article interested me very much because I was at one time connected with the manufacture of ball-bearing rings in Germany. Although the method described by Mr. Kielman requires the use of some expensive and well built machines, I believe it will pay in the long run.

While I am not familiar with the former American practice in the production of ball-bearing rings, I wish to explain how we made them from the solid bar in Europe. For rings 5 in. outside diameter, 4 in. inside diameter, and 1 in. wide, we used a bar slightly over 5 in. in diameter and about 6 ft. long.

The bar was mounted on centers in an ordinary engine lathe. Starting at the tailstock end, we cut four grooves with a set of four special parting tools, leaving the parts between the grooves wide enough to finish to the width of the ring. The diameter of the bar at the bottoms of the grooves was 3¾ in. This operation was continued until the whole length of the bar had been grooved.

By the use of a special L-shaped parting tool, having the sides of the blade ground to the proper curvature, we cut into the bar endwise, similar to a trepanning operation. When the tool reached the first groove, a complete ring was made. The operation was repeated until all the rings were made, leaving a core 3¾ in. in diameter and as long as the original bar. This core was cut up in a similar manner to make rings of smaller diameter.

Since the feed of the lathe was very fine, and automatic stops were used to throw it out at the time the L-shaped tool reached one of the grooves, one man was able to run three or four machines. It was, of course, necessary to set the tools carefully and to supply them with plenty of coolant.

Since we were making rings from a very small diameter up to 10 or 12 in., the waste of material was very small.

Limits of Accuracy in Repetition Work—Discussion

By H. Applegard
Halifax, England

Referring to D. P. Muirhead's discussion, under the title given above and published on page 948, Vol. 64, of the *American Machinist*, I agree that the tables given in my original article (page 389, Vol. 63) are not comprehensive enough for gaging to fine limits, but I feel that it would have been superfluous on my part to have covered the ground that has been so well explored by the Engineering Standards Committee.

My article was written more from the workshop point of view, since experience tends to show that however good the Wickman and other systems of gaging may be, in many workshops at any rate, the main gaging element is the external diameter of the male part. I admit the weakness of this method, but the tables were compiled with the intention of being of practical use to those who confine their gaging to this system, and, on the principle that "Half a loaf is better than none," I believe that the tables are of considerable value.

The limits on female threads were not given, owing to the difficulty of measuring, and also because they are dependent largely on the accuracy of the taps, which did not come within the scope of my article.

In the class of workshops, I have referred to it as usual to make the screws to fit the tapped part; either a slack or good fit as may be required, and where possible the tapped part is produced first. The reason for this is, that a slight adjustment can be made in the die which produces the male thread, whereas the size of the female thread is fixed by the size of the tap employed.

In theory, at any rate, Mr. Muirhead's remarks as to the difference of opinion on the fit of parts in a ring gage, are quite sound. For the majority of screws, however, little difficulty is experienced in practice when a ring gage is used, though I admit the method is not the most efficient.

Automotive Production

Making Rods and Shafts for Diesel Engines

Operations in the forge shop—Two connecting rods are forged on one billet—Lathe work on a one-piece six-throw crankshaft—A large four-piece crankshaft

AN IMPORTANT part of the work of the New London Ship & Engine Co. of Groton, Connecticut, is the building of marine engines of the Diesel type. These engines range in size from 120 to more than 3,000 hp.; most of them being four-cycle engines, though some of the large and more powerful machines operate upon the two-cycle principle. The latter require high-pressure air pumps to inject the fuel charge and low-pressure pumps of large capacity to scavenge the power cylinders of spent gases; these auxiliaries deriving their movement from the main crankshaft.

The forgings from which the rods and shafts for the larger power units are made are quite heavy, and though many of the latter are built up in two or more sections, the individual parts are of sufficient size and weight to tax the capacity of a well equipped forge shop.

In Fig. 1 may be seen a forging that is to be two connecting rods for the scavenging pumps of a 3,000-hp. two-cycle engine. Two rods are forged, end to end, on one billet for convenience in handling. A sling suspends the forging, practically in balance, from the hook of an electric crane, and it is manipulated under the hammer by means of the crane and by extension handles that are clamped to the cold end. When the forging is as nearly completed as may be in this shape it is cut in two and the rods finished separately.

Fig. 1—Forging connecting rods

Oil-burning furnaces are employed to heat the large forgings. In Fig. 2 the piece previously shown under the hammer is being reheated to continue the work.

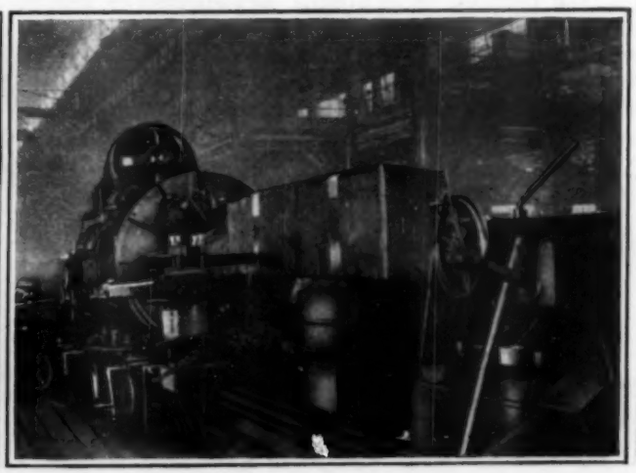


Fig. 2—Heating the forging. Fig. 3—Necking the journals of a large crankshaft

Automotive Production

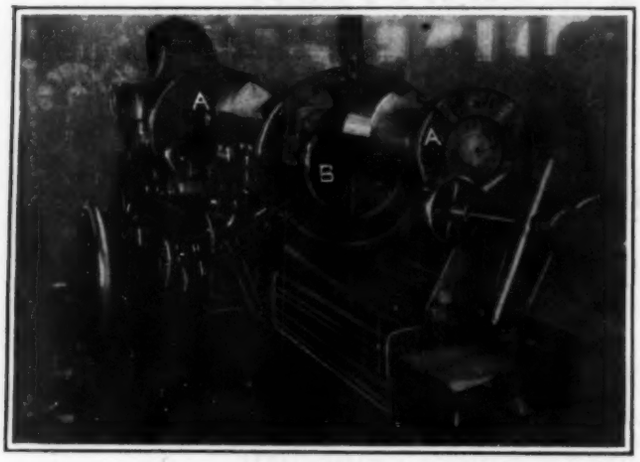


Fig. 4—Shaft in lathe to be turned

With the sliding door of the furnace lowered as far as the presence of the forging will permit, the space between it and the hearth is temporarily stopped with loose firebrick to retain the heat.

The one-piece crankshafts are forged in two stages, between which the partly finished forging goes to the machine shop for a lathe operation. In the first stage the ends of the billet are drawn out roughly to the shape required, while the central portion is merely reduced to a rectangular section of approximately the dimensions of the crank webs.

In the machine shop the forging is placed on a lay-out table and centered for the lathe, and the positions of the main journals are laid off on the rectangular slab. Notches are then cut in from one side of the slab to reduce the section at these points to a size that will clean up conveniently to the journal diameter plus a generous margin of safety to take care of changes in shape when the piece is undergoing the second forging operation.

The usual method of notching the slab is to drill a row of holes closely spaced around three sides of the piece to be removed, after which the piece is knocked out with a sledge or pushed out under a hydraulic press. The sections remaining at the bottom of the notches are then rounded up in a lathe, as indicated in Fig. 3, and the shaft is returned to the forge shop. Here the rough journals are heated, successively, to forging temperature and the shaft twisted to bring the several crank webs into their proper angular relation.

The manner of doing this work is to lay one of the crank webs on the anvil of the steam hammer, bring the hammer down upon it and hold it by admitting steam above the piston. This clamps the piece as in a vise while the helpers, by means of the handles to be seen in Fig. 2, twist the remaining part of the shaft.

Fig. 5—A finished six-throw crankshaft

When the forging again goes to the machine shop the notching operation is continued to remove the stock from between the individual crank webs, leaving sufficient stock at the bottom of each notch to form the crankpin. This work could, of course, be done in the lathe, but would be a time-consuming operation; hence it is done by the drilling method. The forging is then recentered and sent to the lathe to be finish-machined.

Both ends of the shaft are shouldered to take the flanges *AA*, Fig. 4, which are securely keyed and set-screwed to it. In these flanges hardened steel plugs having countersunk centers are set at the proper places to correspond with the radii and angular position of the several crankpins. One or more center-rests are used to steady the shaft while the pins and crank webs are being turned and faced. A split ring, or "spider," shown at *B* in Fig. 4, is eccentrically mounted on the journal nearest to the pin being turned, and presents to the jaws of the center-rest a true bearing that is concentric with the centerline upon which the shaft is at the moment rotating.

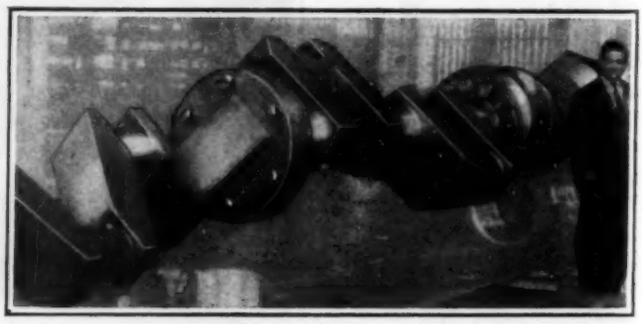


Fig. 6—Four-piece shaft for a large engine

All of the lathe work, including turning the pins and journals as well as turning and facing the sides of the crank webs—a rough and a finish cut over all surfaces—is done without changing the position of the disks on the ends of the shaft. Having completed the work upon any given pair of centers, it is necessary only to call a crane to shift the piece from one pair of centers to another. The centers for the main journals are, of course, in the shaft itself.

The remaining faces of the crank webs, those that are parallel with the centerline of the shaft, are finished by planing them. For this purpose the shaft is mounted upon its own journals in V-blocks secured to the table of a large planer.

A finished six-throw crankshaft, made in one piece, is shown in Fig. 5 on the inspection table, while in Fig. 6 may be seen a four-piece shaft for one of the larger two-cycle engines. This shaft has seven throws; four for the power cylinders, two for the scavenging pumps and one for the high-pressure air pump. It weighs 78,000 pounds.

Graphical Analysis of Circular-Arc Cams

By G. L. Guillet
Associate Professor of Mechanical Engineering
Pennsylvania State College

Graphical construction of velocity and acceleration curves for a flat-faced cam, a cam with offset roller, and one with a pivoted follower—Design of an automotive cam

THE flat-faced or tangent cam has not yet been considered. In Fig. 10 this case is illustrated. The velocity is found by drawing *EC* perpendicular to the cam face to meet *OC*, which is perpendicular to OE. The velocity is $\omega \times OC$, and this distance is used to determine a point on the velocity curve. As regards the acceleration, neither of the constructions used for the circular arc profiles can be applied. If the triangle *OFC*, in which *OF* is parallel to the cam face and *FC* parallel to *OE*, be drawn, then it can be shown that the acceleration is equal to $\omega^2(OE + 2CF)$. Proofs for these statements are as follows: The follower displacement from zero-velocity position, at cam displacement θ, from the figure is equal to

$$s = OE - (r + r') = \frac{r + r'}{\cos\theta} - (r + r')$$

$$\text{Velocity, } v = \frac{ds}{dt} = \frac{d(r + r')}{dt \cos\theta} = \frac{\omega(r + r')}{\cos\theta} \times \tan\theta$$

$$= \omega \times OE \times \tan\theta = \omega \times OC$$

$$\text{Acceleration, } a = \frac{dv}{dt} = \frac{d}{dt}\left[\frac{\omega(r + r')}{\cos\theta} \times \tan\theta\right]$$

This differential may be written in the form

$$a = \frac{\omega^2(r + r')}{\cos\theta} + \frac{2\omega^2(r + r')\tan\theta}{\cos\theta} \times \tan\theta$$

and since $OE = \frac{r + r'}{\cos\theta}$, and $OC = \frac{r + r'}{\cos\theta} \times \tan\theta$

$$CF = OC \tan\theta$$

$$a = \omega^2 \times OE + 2\omega^2 \times CF = \omega^2 \times (OE + 2CF)$$

The distance $(OE + 2CF)$ is plotted as an ordinate on the acceleration diagram of Fig. 10. As before the full-size scale is 1 in. $= \frac{\omega^2}{12}$ ft. per sec. per second.

In Fig. 11, the roller center is offset. The case illustrated is similar to that of Fig. 6, with the exception of the offset. The offset necessitates only a slight difference in the construction: Klein's method is used as before. The line of stroke is now *EG*, and the offset equals *s*. Line *OC* represents the velocity and is drawn perpendicular to *EG*. Line *BF*, drawn perpendicular to *EA*, meets *OD*, parallel to *EG* at *D*. The distance *OD* represents the acceleration to the scale 1 in. $\frac{\omega^2}{12}$ ft. per sec. per sec. By means of slight alterations in Figs. 7, 8, and 9, an offset can be provided for in these cases also.

The pivoted-follower mechanism of Fig. 12 has as its equivalent link mechanism a quadric crank chain, the links being *EH*, *EA*, *OA* and *OH*. Since *E* moves in a direction perpendicular to *HE*, we can regard *E* as being, for the instant, constrained to move along *EG*. Consequently, the construction required for the velocity and acceleration ordinates is identical with that of Fig. 11. The angular velocity of the follower, if required, can be found by dividing the velocity of *E* by the length *EH* for various intervals.

A cam producing constant velocity of the follower during its lift or drop period is out of the question for practical use except at very low speeds of rotation,

The second and concluding article.

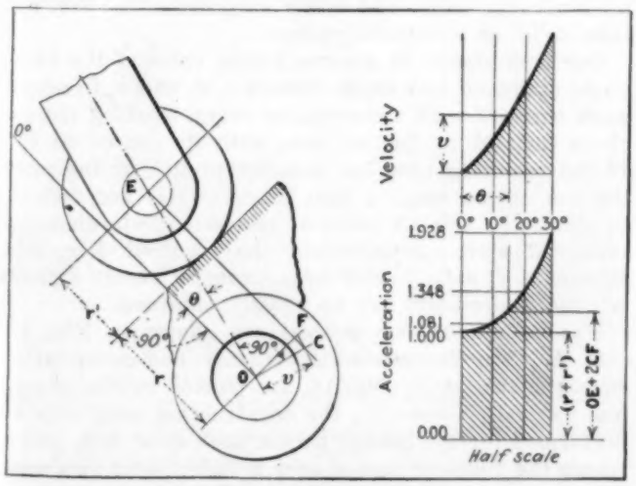


Fig. 10—Construction of velocity and acceleration curves for a flat-faced or tangent cam

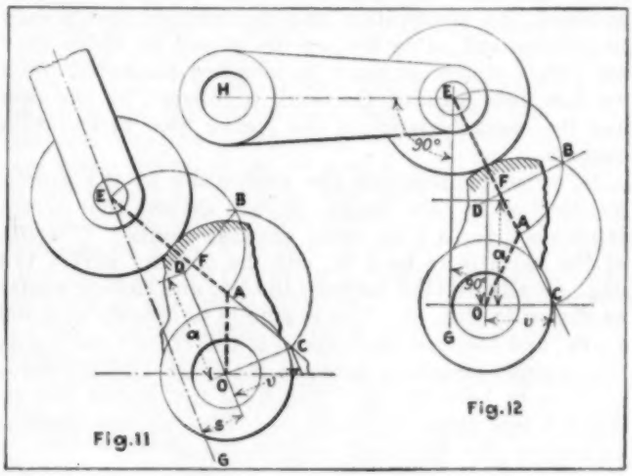


Fig. 11—Offset roller-follower. Fig. 12—Pivoted follower

since a sudden change of velocity occurs at the beginning and the end of the movement, and results in infinitely large accelerations at these instants. Even where constant velocity is desirable for the application, the cam is usually modified at the beginning and the end of the lifting surface to give an acceleration and deceleration of reasonable value. The higher the cam speed, the longer must the modified portions be in order to keep down the maximum values. In cases of very high speed, the constant-velocity portion is often eliminated and the whole lift period is used for acceleration and deceleration. This is true of the usual form of valve cam for high-speed engines.

Where the specifications call for a certain movement to be executed in a definite period, it is obvious that no matter what the shape of cam may be, the *average* velocity of the follower during this period is always the same. Our problem, then, is to choose a cam surface that will cause the velocity to vary in the most suitable manner. If we consider inertia effects alone and disregard for the moment the variation in spring pressure during lift, then for smoothest operation involving least maximum stresses and least spring pressure, the acceleration and deceleration should each be of constant value during the period in which they act. This statement must be modified somewhat when we take into account the work performed by the cam and the characteristics of the spring used to maintain contact.

In order to illustrate the application of the graphical method to cam design, we will assume that a cam is required for a high-speed gasoline engine: The lift of the valve is to be $\frac{3}{8}$ in. and the opening period 114 deg., equally divided between the lift and closing angles as shown in Fig. 13. The engine is to operate at 2,500 r.p.m., and the cam shaft speed is therefore 1,250 r.p.m. The normal clearance between the lifter and the valve stem is to be 0.005 in. The total lift period will be divided into three intervals for which we will attempt to satisfy the following requirements:

Period 1. A slow-lift period, during which the follower is to move about one and one-half times the standard clearance, the maximum velocity at the end of this period being not greater than 1 ft. per sec. This limit avoids noisy action because of the low striking velocity.

Period 2. A rapid acceleration period, during which the acceleration should not exceed 4,500 ft. per sec. per sec. This limit is imposed by considerations of weight of reciprocating parts, and the resulting pressure between follower and cam.

Period 3. A deceleration period, during which the spring is depended upon to maintain contact. This period should be as long as possible as this results in a low value of deceleration. The deceleration should preferably increase somewhat toward full lift so as to conform with the spring pressure curve. The requirement for this period is attained if period 2 is short and the positive acceleration correspondingly large.

Assuming constant acceleration for the first period, a final velocity of 1 ft. per sec. and total lift of 0.0075 in., we can calculate the time and the angular movement of the cam. This is found to be

0.0075 in. for 9.3 deg. and 0.005 in. for 7.6 deg.

We will use 9 and $7\frac{1}{2}$ deg. respectively.

The cam consequently begins to lift the follower at 25.5 deg. from the reference line as shown in Fig. 13, begins to open the valve at 33 deg., and attains 0.0075 in. lift at 34.5 deg. The acceleration required is found to be 830 ft. sec. per sec. by calculation.

By reference to Fig. 4 in the first article, it will be

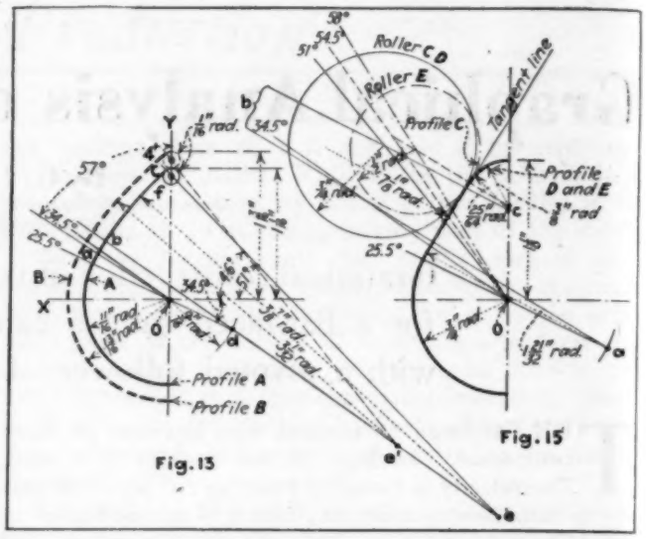


Fig. 13—Construction of automotive cam with flat-face follower. Fig. 15—Construction of cam with same characteristics as Fig. 13, but with roller follower

seen, near the dead center position, that acceleration is approximately represented by the distance from the center of curvature to the cam center. This is distance *od* in Fig. 13, the scale being 1 in. $= \frac{\omega^2}{12} = \left(\frac{1{,}250 \times 2\pi}{60}\right)^2 \times \frac{1}{12} = 1{,}430$ ft. per sec. per sec. when the diagram is full size.

The distance *od* is therefore $\frac{830}{1{,}430} = \frac{9}{16}$ in. nearly. Center *d* is therefore located on the 25.5-deg. line at $\frac{9}{16}$ in. from point *o*.

During the second period the acceleration is not to exceed 4,500 ft. per sec. per sec. The distance *oe* must be about $\frac{4{,}500}{1{,}430} = 3.15$ in., since we still approach dead-center conditions. Also *b*, *d*, and *e* must lie in a straight line. Point *e* is therefore determined.

The radius of the toe should be as small as possible consistant with good wearing qualities. This results in the smallest possible size of cam with least rubbing velocity, cost, and space requirements. We will take $\frac{1}{8}$ in. as a suitable radius.

Our next step is to assume a trial value of the base-circle diameter, and using centers *o*, *d*, and *e*, in order, work outward with a continuous curve, locating the toe circle tangent to the last arc, with its center on *oY*. If the resulting cam has insufficient lift, it indicates the use of too small a base circle. It is not difficult to obtain, by trial, a value of the base circle diameter that will give approximately the required $\frac{3}{8}$-in. lift. By means of a final small adjustment of center *e* along *bd*, the desired lift can be exactly obtained.

The results of this process are shown in Fig. 13, cam *A*. The corresponding velocity and acceleration curves shown at *A*, Fig. 14, are plotted by the graphical method. Generally, the construction need only be performed for the change points, such as at *a*, *b*, and *c*, where the follower passes over a junction of two arcs. The shape of the intermediate portions of the curve can be closely estimated when the portion of the harmonic curve being used is known.

The acceleration curves for this type of cam have a very desirable shape, the top being almost flat during the first two periods and the deceleration portion rising toward full lift. The latter condition, as already pointed out, is suited to spring characteristics.

The effect of possible alterations will now be considered. (a) By maintaining the same location of the centers *o*, *d*, *e*, and *f*, we can draw larger or smaller cams. These will all have the same acceleration curve. The toe becomes a sharp point when the radius is reduced $\frac{1}{8}$ in. This modification is undesirable, while in the other direction the cam becomes unnecessarily large.

(b) By keeping the toe radius and lift constant, increasing the base-circle radius $\frac{3}{8}$ in. and using the same center *d* for the slow-lift period, we reach a profile shown by the broken lines as cam *B* of Fig. 13. Center *e* has been altered to location *e'* in order to connect the toe and flank arcs. The corresponding velocity and acceleration curves are the *B* curves of Fig. 14. The change results in a much lower positive acceleration with a somewhat increased deceleration. Although the *B* design calls for a larger cam with higher sliding velocity and also a slightly heavier spring, it would seem that these drawbacks are more than counterbalanced by the large decrease in the acceleration. It should be pointed out, however, that increase in spring pressure is a more potent factor in producing wear than an increase in the acceleration, since the former is in effect during the whole lift period, while the latter only acts through a few degrees. Moreover, the normal engine speed may be much less than the maximum, and at lower engine speeds the acceleration pressure is lessened, while the spring pressure is unaffected. To make an intelligent choice, the normal engine speed, weight of reciprocating parts of cam mechanism, cam width, etc., should all be taken into account. (c) If the toe radius and lift are kept constant, but the base circle is decreased, a smaller cam will result. The acceleration is increased, however, and our limit of 4,500 ft. per sec. per sec. is exceeded.

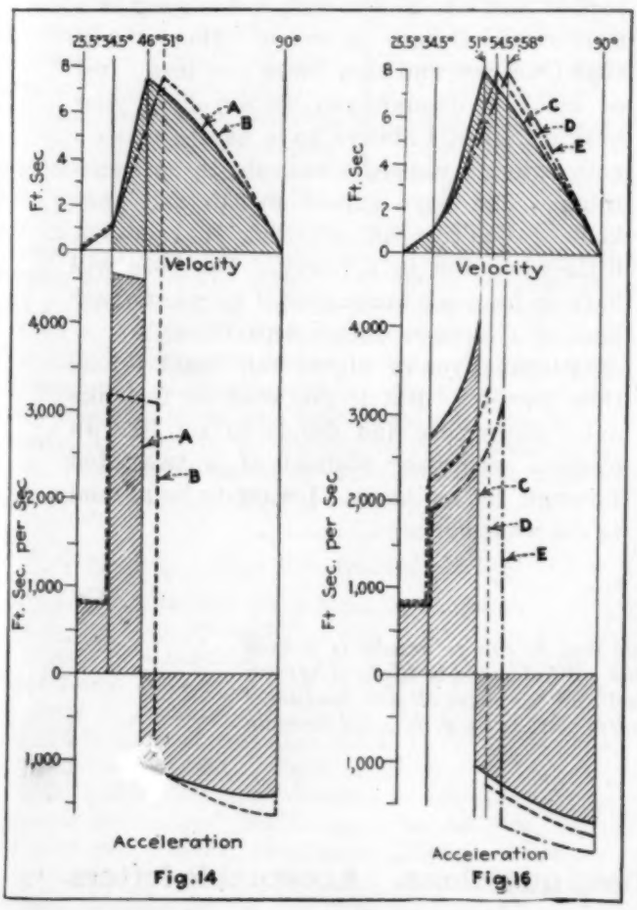


Fig. 14—Velocity and acceleration curves for the cam shown in Fig. 13. Fig. 16—Curves for cam shown in Fig. 15

Design of Roller-Follower Cam

Roller-follower cams to fill the same requirements as stated above are shown in Fig. 15. On account of the concentrated pressure on the pin on which the roller turns, it is customary to use a lower positive acceleration value in this style cam, as compared with the flat-follower type. The cam designated as *C* in Fig. 15 was intended to duplicate the motion of *B*, Fig. 13, as closely as possible. The proper base-circle and roller diameter must be found by trial. The values selected for cam *C* were: roller diameter $1\frac{1}{4}$ in., base-circle diameter $1\frac{1}{2}$ in. Center *a* must be placed in such a position on the 25.5-deg. line as to give an acceleration ordinate of about $\frac{3}{16}$ in., as calculated for the flat-faced follower mechanism. The same method as used in Fig. 7 is employed. Center *b* is then located so as to end the acceleration period at 51 deg. to correspond with the *B* cam, and also to permit of a final arc being drawn so as to give a $\frac{3}{8}$-in. lift. Center *b* is to the left of the cam, and the surface is concave. Plotting the velocity and acceleration curves by the methods of Figs. 7, 8, and 9, we arrive at the result illustrated in Fig. 16, curves *C*. The acceleration curves of *B* (Fig. 19) and *C* differ as to the form of the peak on the positive loop; at other points they are practically identical.

Two changes in the mechanism are indicated by *D* and *E*, Figs. 15 and 16 as follows:

Cam *D* is of the tangent type, having a flat flank instead of a concave one. The roller and base-circle size, and the location of center *a* are unchanged. Curve *D* shows a decreased positive acceleration accompanied by a slightly higher deceleration.

Cam *E* is of the same shape as cam *D*, but the roller diameter has been decreased to 1 in. This modification results in a further decrease in positive acceleration values, (curve *E*, Fig. 16) and an increased and more nearly constant deceleration.

Of the three cams, *D* appears to be the best. The spring need only be slightly heavier than for *C*. The positive acceleration is less, and a flat face is preferable to a concaved face for manufacturing reasons. With the smaller roller used in *E*, the spring requirements are materially increased; hence this design is inferior.

When using a tangent cam, the positive acceleration is directly proportional to the roller radius plus the base-circle radius, as can be seen by reference to Fig. 10. The result of reducing the sum of these two quantities is the same whether the cam is made smaller or the roller size is reduced; acceleration is lessened in either case. This reduction is bound to result in a higher deceleration, which demands additional spring pressure. Curves *D* and *E*, Fig. 16, illustrate this comparison.

THE · FOREMAN'S · ROUND · TABLE

Should Foremen Be Good Actors?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

THE foremen's conference had just listened to an inspirational address, by a professional 'uplifter,' on how to handle men. Al and Ed were on the way back to the machine shop. Al looked thoughtful and grinned occasionally as he recalled various admonitions that had been flung at him. Ed was openly disgusted.

After grumbling incoherently for several seconds he could hold in no longer. "Al," he burst out, "where does that guy get his license to tell me how to talk to my men? How does he know what kind of talk will make those roughnecks get out production?"

"Well," said Al, soothingly, "he has to believe he knows all about handling men everywhere or he couldn't go on talking about it. I got one or two thoughts out of what he said that I think I can use."

"Maybe you did, Al, but I didn't. Can you imagine me asking Big Jo Slavitsky to 'please accelerate his lathe by transferring the driving belt to the next step on the cone, there's a good chap'? Wouldn't I sound nutty? Big Jo would certainly believe I was."

Al laughed. "He probably would, Ed. And he wouldn't be far wrong. Whenever I hear you say anything like that in that tone of voice I am going to hunt cover."

"I may sound funny," returned Ed, "but I don't feel funny. It's all right for a quiet sort of bird like you to talk to his gang in a conversational tone of voice. They expect that from you and they know you mean just as much as though you were yelling your head off. But I always have had to make a noise when I wanted somebody to do something. The boys expect me to and they know I don't mean anything if I cuss a little when I'm in a hurry. The boss will have to have me made over if he wants that kind of a foreman in my department."

"Perhaps you're right, Ed," said Al as they parted. "But if you ever do feel like John Barrymore and decide to act like an elegant supervisor instead of a two-fisted foreman, let me know. I want to be around to see what happens."

Is Ed right in believing that the only way he can get results is to keep on with the manner his men are used to? What would be likely to happen if he should suddenly try to act a part and use more elegant language? Which man is likely to get the best results from his gang, the quiet foreman or the outspoken one?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Keeping Machines on the Job

SOME may, and doubtless do, deem it the best policy to erect the "warning" sign once the accident has occurred, but I agree, with Al, that it is the truer wisdom to forestall trouble. It is quite possible and it is unquestionably good policy to keep intelligent oversight on machinery and equipment. A periodical inspection by one who knows what to inspect and how to inspect it is a really paying proposition. Many times disaster has been thus averted.

The maintenance and repair man occupies a post of great importance. The better the maintenance the less the amount of repair necessary. With proper co-operation between the foreman and the maintenance man the inspection can be so scheduled that it will not interfere with production. The great disadvantage where the maintenance man is subordinate to the various foremen is that his wings are clipped and he is embarrassed with too many bosses. His work is highly important and he must be able to undertake it free from capricious and hurtful interference. It is simply up to the foreman and the maintenance superintendent alike to realize that tools and equipment must be kept up to pitch. Each must remember that the interests of what is greater than their private feelings or personal dignity are at stake. True pride should welcome the best results however or by whomever they are achieved.

The wide-awake, "Al-type" foreman will welcome gladly a tightening of screws—anything which will keep his machines running smoothly. He knows that the more thorough-going the maintenance is, the better opportunity there is for himself to really make good. It is the good we would do but cannot, which galls. —W. ROLAND NEEDHAM, *England.*

Letting a Man Try His Own Way

I DO NOT think that Ed is right in compelling a man to do his work the way in which it was done before. No matter how anything is done today, there is always a better way of doing it, and no matter how smart we are there is always some one else who knows how to do a job in a better way than we do it. What is good practice today may be obsolete tomorrow.

If Ed had a few more Jimmies in his department, he would have more time to spend on his other men who have only ordinary intelligence. Jimmie can safely be given free rein if his ability will warrant it, and the foreman should know the ability of his men.

In my shop every operation is recorded and filed in an index system which shows how it was successfully done before. This layout is revised whenever anyone can develop a better method of doing the job. By the application of justice, the giving of a square deal and the demanding of one in return, there need be no sacrifice of discipline.—C. L. HENRY, *England.*

Some Advantages of Foremen's Conferences

IF THE same relations between employee and foremen, as apparently obtained between Al and Scotty, existed in every shop, a man in most cases would not only discuss his ideas with his foreman, but would also get his co-operation in putting them in presentable form, on paper. The real reason why ideas get no farther than the workman's mind is often because he lacks ability to commit them to paper. Is Williams likely to favor the suggestion of holding foremen's meetings? Williams will not wait for a suggestion to call a meeting of foremen. Seeing that he has started right in investigating ideas or devices and discussing them personally in his office with the men, he will start a foreman's round table conference himself. In these meetings any knotty point in production can be thrashed out and ways and means of overcoming it suggested. In the same way, grievances of departments against one another, such as shortage of parts or material, or holding up output, can be straightened out.

The superintendent can soon tell whether he is getting co-operation, not only for himself but between departments.—ARTHUR SILVESTER.

Letting a Man Try His Own Way

AL IS right in advising Ed to allow his men to try their own way if it is a good way. If you want to get the most out of employees, let them use their own heads. If you see that they are going about the work in a way that will take more time than is needed, suggest to them that another way is better, or might be somewhat easier or quicker. The writer always lets his men use their own initiative until he sees that their method is using up too much time. Thus far the men have responded to the plan very well and with few exceptions.

It is not given to any one man to know everything, nor all the good ways of doing a piece of work. We are often surprised to find the number of good ways there are of doing a job. Two of the most successful toolroom foremen of whom I know get results from practically the same methods that I have described, and, like the writer, claim that it keeps them from getting rusty.—C. G. WILLIAMS.

THE · NEXT · TOPIC

Getting Men to Observe Safety Rules

QUESTIONS

Is it up to the foreman or to the safety department to establish safety rules?

Who should enforce them?

How can a "safety tradition" be built up in a shop?

Who pays when a man is injured?

Ideas from Practical Men

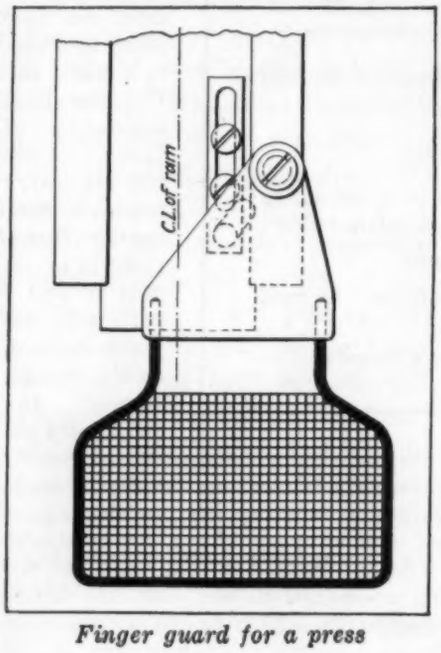
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Guard for a Punch Press

BY EDWARD T. HEARD

The illustration shows a guard for a punch press that may be of interest to readers of the *American Machinist.*

A casting or forging, roughly triangular in shape is pivoted upon a shouldered stud set into the frame of the press at a suitable location beside the ram, and is free to swing upon the frame in a vertical plane. A radial slot in the triangular piece engages a pin or stud which is pressed into a bracket adjustably attached to the ram. The framework, which comprises the actual guard, is of heavy wire, or of cold-rolled rod of small diameter, shouldered at the ends to be driven into the casting and bent to any shape required to suit the press and the nature of the work. It is covered with a screen.



Finger guard for a press

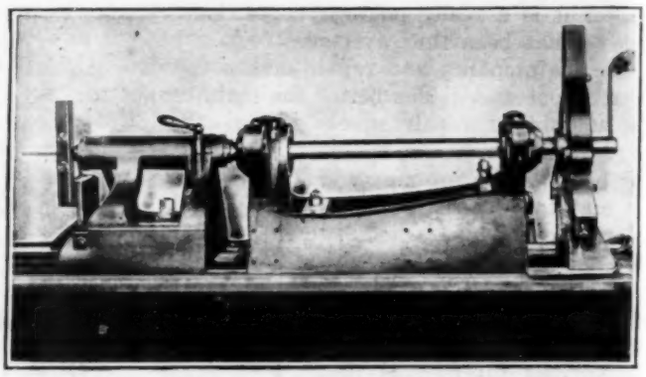
When the ram is at the top of the stroke, the guard is at the left. As the ram descends, the guard moves to the right until the ram is at the bottom of the stroke, when it is in the position shown in the illustration. The cam-slot, shown here as a straight radial slot, may be made of any shape to bring down the guard slowly or quickly, as may be desirable.

Reboring the Spindle Bearings of a Lathe

BY ROBERT R. DURFIELD, JR.

The spindle bearings of our 32-in. lathe became worn to such an extent that it was necessary to close them up and rebore them.

Since we had no boring machine, it was necessary for us to improvise means for doing the work. A boring bar was made, having cutter slots the same distance apart as were the bearings to be bored. A fine-thread screw, small enough to go through the screw hole in the tailstock tube, was fastened to one end of the bar. Before the lathe was taken apart, a bushing was made and clamped in the steadyrest. The steadyrest was placed close to the tailstock and the bushing was bored out in place to fit the boring bar. The tailstock spindle was removed and a bushing was made to fit both the boring bar and the bore of the tailstock.



Set-up for reboring spindle bearings

The headstock was placed between the steadyrest and the tailstock, as shown in the illustration. The bar ran in the bushings in the steadyrest and the tailstock and was revolved by a crank at one end. The fine-feed screw at one end of the bar, protruded from the rear of the tailstock. Two pieces of wood clamped on the screw, and blocked so they would not revolve, acted as a feed nut. Both bearings were bored together.

Drilling Formica Tubes

BY OLIVER FRANKLIN

A company that manufactures radio receiving sets uses a rather clever jig for drilling a half-dozen holes in thin Formica tubes used to make radio inductances. The black Formica tubes are purchased cut to the desired length, and the first operation is drilling.

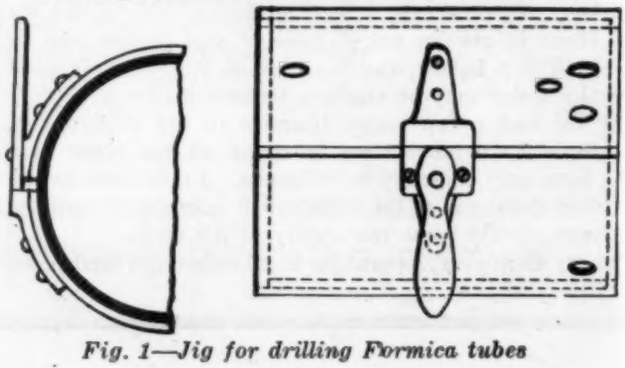


Fig. 1—Jig for drilling Formica tubes

The jig shown in Fig. 1 principally consists of a mild steel shell about $\frac{1}{8}$ in. in thickness with a slit extending along its entire length. The inside diameter of this jig is slightly smaller than the tube to be drilled and a cam-shaped lever is used to spring the

Fig. 2—Drilling operation

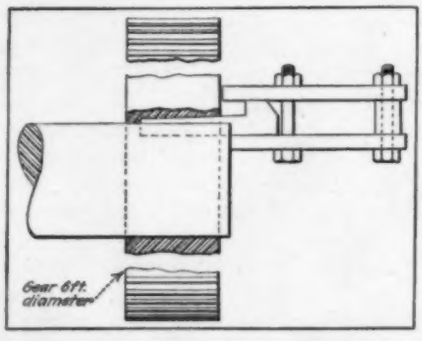
shell open at the slit and thus permit the insertion of the tube. When the cam is released the tube is clamped firmly in place. An inside shoulder locates the piece endwise. Hardened steel bushings are used to locate the drilling positions.

The jig assembly with the contained tube is put in a V-block, which can be moved about on the drill table as shown in Fig. 2. A high-speed sensitive drill is used, and two spindles are provided to take care of two sizes of holes. The drill bushings are slightly oversize in order to prevent the drill from jamming should the bushing be not exactly in line with the drill.

Device for Removing Gib Keys

By Karl Bell

The usual method of removing a gib key is to drive a wedge or a cold chisel between the head and the hub of the wheel. If the key has been driven tightly, this method often results in bending the head so that wedge will fly out when struck by the sledge. Sometimes the key will break and will have to be drilled out. With the device shown in the illustration, the key is supported by the lower member of the clamp bearing against the shaft and will not bend so readily. Of course, after the key has been started the support ceases to be effective, but if the key should bend, the upper member of the clamp will act as a retainer for the wedge and will prevent it from flying out.



Clamp and wedge for extracting gib keys

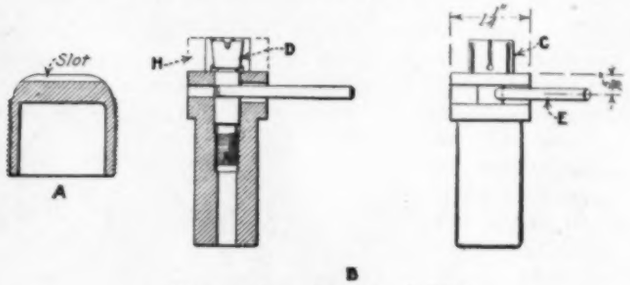
An Expanding Adapter

By William Van Assen

Having to slot a large quantity of threaded pieces, such as shown at *A* in the illustration, we made the adapter *B* for holding them by the inside, so as not to mutilate the threads. The adapter is held in the indexing chuck in a hand milling machine, being seated by bringing the shoulder in contact with the top of the chuck jaws.

In operation, the work is put on the split bushing *C*, which is then expanded by screwing down the plug *D* part of a revolution. While expanding the bushing, revolving the plug also brings the work down so as to seat it on the top of the adapter. The plug is revolved by the lever *E*, a slot being cut in the body of the tool to allow it to turn nearly half a revolution.

The collar *H*, having a hole of the same size as the hole in the work, is used as a gage for locating the



The work and the adapter

plug when drilling the hole for the lever. It is placed on the bushing and the bushing is then expanded to hold it tightly, the adjustment being made by a screwdriver engaged in a slot at the top of the plug. The collar is also used to protect the adapter from injury when it is not in use. It is placed over the bushing and locked, thus preventing the bushing from being expanded beyond its elasticity by swinging the lever so as to screw the plug down too far.

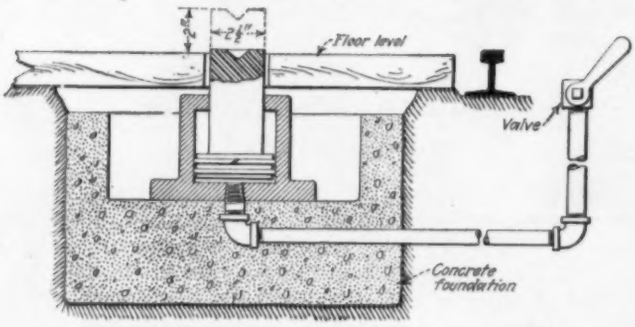
Air Cushion Simplifies Riveting

By George Feltner

The other day while in the Northern Pacific shops at St. Paul, Minn., I saw a piece of metal on the floor that resembled a washer, and thinking it might be of service, I attempted to kick it to one side. To my surprise the foreman laughed as he told me it was an air cushion for riveting purposes. I obtained further details and in the illustration is shown its construction. The device is used principally for riveting piston heads, although miscellaneous operations are handled on it. Until the cushion was installed it required two men to rivet large-sized work, whereas the same operations now are handled by one operator.

The cylinder is a single-acting unit, provided with an air inlet at the bottom. The piston or plunger is 2½

in. in diameter at the smaller end, while the opposite end it is slightly larger and is provided with packing rings as shown. A movement of 2 in. above the floor level is reached when the piston is in an upward posi-



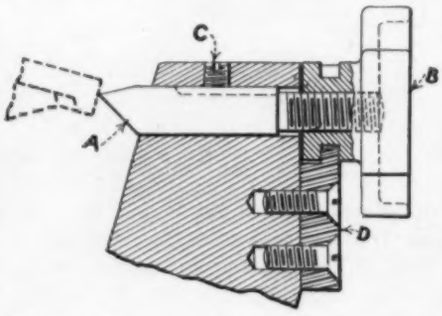
Device for riveting miscellaneous work

tion. Air pressure of 90 lb. is used. If a solid backing is used for this class of work, the riveting hammer generally jumps about beyond control, but with the air cushion illustrated, this difficulty is not experienced.

Work-Holding Device for Jigs and Fixtures

By Edward T. Heard

The holding device shown in the illustration is for use at one end of a jig or fixture, the opposite end being provided with a stop or other means for preventing endwise motion of the work. The knife-edged plunger *A* being set at an angle, tends to draw the work down on the bed of the jig or fixture as it is moved outward. The plunger is threaded at the rear end and is operated by the hand nut *B*. It is kept from turning by the screw *C* engaging a keyway at its top. In order that the hand nut will operate the plunger in both directions, its hub is grooved to fit the jaws of the thrust plate *D*, which is attached to the back of the fixture, as shown.



Holding device for jigs and fixtures

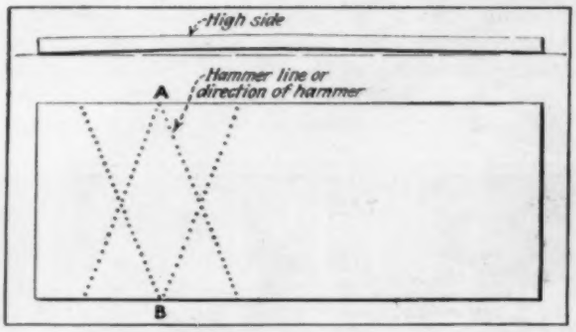
While devices of this kind have plenty of power to hold the work securely, they are sensitive enough to permit the user to apply the necessary force without danger of springing it.

Straightening Cold-Rolled Plates—Discussion

By A. F. Fontanella

In an article under the title given above, published on page 870, Vol. 64, of the *American Machinist*, H. R. Fowler details his troubles in straightening cold-rolled plates, and asks for the experience of others.

I have found that plates can be straightened to a fair degree of accuracy by hammering on the high side. The hammering should follow an angular course, com-



How the hammering should be done

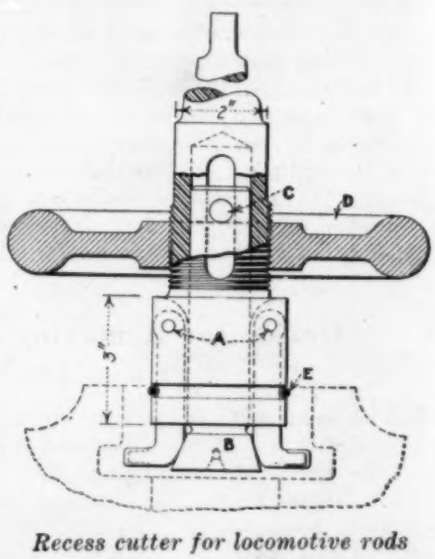
mencing at *A* in the illustration and gradually working toward the opposite side. Then commence at *B* and work over to the first side.

I have never investigated just what happens to the plate in the process, whether the skin stretches or not, but I know the plates become straight by the method outlined.

Recessing Tool for Cutting Grease Pockets in Connecting Rods

By L. L. Locke

To form suitable grease pockets in locomotive connecting rods, it is necessary to machine undercuts below the threaded portions of the grease-cup holes. While there are several ways in which the cuts can be produced, the tool shown in the illustration, although of a simple design, is being used successfully for the operation. It is used in a drill press, being held and driven by the usual Morse taper. Two cutting tools are attached to the body by the pins *A*, so they can be expanded by the tapered part of the plunger *B*. The plunger is operated by the pin *C* that is drawn upward when the handwheel *D* is held stationary as the tool revolves. The feed is actuated at intervals to suit the nature of the cut and to avoid a strain on the cutting tools. Since accuracy is not important there is no stop on the tool, although the operator gages the depth of the recess by position of the handwheel on the threaded portion. When an approximate enlargement has been reached, the tool is fed downward a silght distance.



Recess cutter for locomotive rods

To remove the tool, the machine is stopped and the handwheel screwed down so that the plunger moves outward. A retaining spring in the groove *E*, withdraws the cutting tools to their normal position. A soda-water cutting compound is used in connection with the operation.

Wage Payment Systems

"Olds" Bonus Plan

In the standard time system with a bonus reward each employee receives a fixed hourly rate, and an additional bonus is paid according to the speed of production. The standard time is defined as the time required to perform a given operation by the average competent workman repeatedly over an extended period. The purpose in offering a bonus for gains above the standard time on an operation is to stimulate the workman to greater effort.

All time used in computing the labor hours is converted into decimals. The speed of production is based on the assumption that the standard time is 100 per cent. It is termed the efficiency, and is obtained by dividing the total standard hours credit for a job by the total actual hours worked.

Until the employee has passed an efficiency of 75 per cent he remains on a flat day rate of wage. The accompanying table shows the percentage increase in pay over the day rate to be paid to the employee for each one per cent increase in efficiency from 75 per cent to 200 per cent. For efficiencies above 200 per cent 1.2 per cent is added to the bonus percentage for each one per cent increase in efficiency.

The bonus may be applied to individual effort or to groups of workmen. As an example, it is assumed that a workman receives a base wage of 40c. per hr., and has completed 900 pieces of a part with a standard time of 0.016 hr. per piece, and 200 pieces of another part with a standard time of 0.457 hr. per piece, and 100 pieces of still another part with a standard time of 0.142 hr. per piece. Then the standard credit hours would be equal to 900x0.016 plus 200x0.457 plus 100x0.142, or a total of 120 standard hours credit. Since he actually worked only 100 hours his efficiency is $\frac{120}{100}$, or 120 per cent. From the table it is seen that 120 per cent efficiency pays a bonus of 44 per cent. The workman, therefore, gets as his wage the standard amount of 100x40c. plus an earned bonus of 0.44x$40, making a total of $57.60 earnings for the period of 100 hours worked.

Group Bonus

Where a number of workmen are employed in a group to complete a series of operation on a given part, and the base wage rates and number of hours worked vary for each employee, the bonus can still be applied. Assume, for example, that employees *A*, *B* and *C* are working in a group, and that during a pay period employee *A* put in 80 hours, *B*, 70 hours and *C*, 100 hours. The base wage of employees *A* and *B* is 40c. per hur., and for employee *C* the base wage is 45c. per hr. During the period it is assumed that the group completed 600 pieces having a standard time of 0.50 hr. per piece.

Bonus Table, Productive Workers

Per Cent Eff.	Bonus	Per Cent Eff.	Bonus	Per Cent Eff.	Bonus
75	1.0	117	40.4	159	90.8
76	1.6	118	41.6	160	92.0
77	2.2	119	42.8	161	93.2
78	2.8	120	44.0	162	94.4
79	3.4	121	45.2	163	95.6
80	4.0	122	46.4	164	96.8
81	4.6	123	47.6	165	98.0
82	5.2	124	48.8	166	99.2
83	5.8	125	50.0	167	100.4
84	6.4	126	51.2	168	101.6
85	7.0	127	52.4	169	102.8
86	7.6	128	53.6	170	104.0
87	8.2	129	54.8	171	105.2
88	8.8	130	56.0	172	106.4
89	9.4	131	57.2	173	107.6
90	10.0	132	58.4	174	108.8
91	11.0	133	59.6	175	110.0
92	12.0	134	60.8	176	111.2
93	13.0	135	62.0	177	112.4
94	14.0	136	63.2	178	113.6
95	15.0	137	64.4	179	114.8
96	16.0	138	65.6	180	116.0
97	17.0	139	66.8	181	117.2
98	18.0	140	68.0	182	118.4
99	19.0	141	69.2	183	119.6
100	20.0	142	70.4	184	120.8
101	21.2	143	71.6	185	122.0
102	22.4	144	72.8	186	123.2
103	23.6	145	74.0	187	124.4
104	24.8	146	75.2	188	125.6
105	26.0	147	76.4	189	126.8
106	27.2	148	77.6	190	128.0
107	28.4	149	78.8	191	129.2
108	29.6	150	80.0	192	130.4
109	30.8	151	81.2	193	131.6
110	32.0	152	82.4	194	132.8
111	33.2	153	83.6	195	134.0
112	34.4	154	84.8	196	135.2
113	35.6	155	86.0	197	136.4
114	36.8	156	87.2	198	137.6
115	38.0	157	88.4	199	138.8
116	39.2	158	89.6	200	140.0

The standard hours credit for the group is 600x0.50, or 300 hr. The total hours actually worked by the group is 80 plus 70 plus 100, or 250 hr. The group efficiency is, therefore $\frac{300}{250}$, or 120 per cent. The bonus table shows that 120 per cent efficiency allows the payment of 44 per cent above the base wage. This percentage is then added separately to each employee's base wage, resulting in earnings of $46.08 for *A*, $40.32 for *B*, and $64.80 for *C*.

The purposes of the "Olds" plan of offering a bonus reward for production are: To stimulate the workmen to greater effort; to reward them in proportion to the effort; to furnish a standard for the measurement of the rate of production; and to measure the relative efficiency of the workmen.

For the information given we are indebted to the Olds Motor Works, General Motors Corporation

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Calculating Machine Hour Rates

Q. Can you give us any information on the method of figuring machine hour rates?

A. Machine hour rates are determined by apportioning to each machine and process a proportional share of the total expense of running the plant. The total of the expenses to be allocated to the machine is made up of the first cost of the machine, the depreciation, and a proportional share of the shop overhead such as cost of supervision, heat, lighting, and rent.

The share of shop overhead to be borne by the machine is determined in proportion to the shop area occupied by the machine, and by the special considerations such as horsepower. For this calculation the shop is divided into areas allocated to each machine, tool, or process, and the percentage of total area is taken as the percentage of shop overhead to be employed.

Machine operating costs are determined by the year or month, and the hourly rate is then found by dividing by the average number of hours that the machine is expected to operate during the period. A fault with the machine hour system is that if a machine is not operated the exact time expected an undercharge is made, and the contract job is accordingly done at a loss. If, on the other hand, the calculation is used to cover a job that will keep the machine busy more than the estimated time, the price set will be too high, and the shop may lose the job in competition with another shop.

Machine hour rates are good in theory, but they are usually not found as practical for general manufacturing as a monthly balancing of overhead costs. As an example, the whole supervisory force of a department may be concentrated for days at a time on one machine or process, and as a consequence it would be unfair to charge all of the other machines with a share of overhead expense that they did not receive.

Light, power, and other factors are likewise too variable to be divided on the basis of space alone. To obtain any real accuracy in practice, therefore, each item relating to the machine must be determined by special considerations. For a manufacturing plant the machine hour system is usually considered too complicated, and its only practical use is for contract job shops, or for special machines for special work, or for making actual cost comparisons between processes.

The Herringbone Gear

Q. What are the advantages of a herringbone gear over a plain spur gear?

A. Several advantages are claimed for the herringbone gear. The first is a smoother and quieter action because of the elimination of shocks when the load is transmitted from tooth to tooth. By the cutting down of the backlash the vibration is also eliminated. A third advantage is the decreased bending action on the teeth, which permits the transmission of greater power for a given size of gear. As a consequence of these factors the herringbone gear will give longer life, and at the same time economize on power. The nature of the gear also allows a high ratio of reduction in a single gear train.

Welding Rod for Cast Iron

Q. We often have occasion to weld cast-iron parts, and would like a statement as to the advantages, if any, of bronze welding rod as compared with cast-iron rod.

A. Bronze welding as compared with the use of a cast-iron welding rod is still a matter of discussion. Advocates of bronze welding on cast iron are frequently enthusiastic in regard to the results obtained. Theoretically, a welding rod of approximately the same material as the parts to be welded should be used, but some welders claim that a good bronze weld will be stronger than the cast iron of the piece.

The chief advantage of bronze welding is probably due to the fact that it can be done without pre-heating the parts. This often saves dismantling the broken machine, and also permits rapid handling of miscellaneous parts to be welded. Bronze welding is valuable for welding malleable iron, since the low heat required does not change the nature of the iron.

Drilling Long Holes in Wood

Q. We are contemplating the manufacture of shuttle quills in our own machine shop. These quills are hard maple blocks 1⅞ in. square and 8¼ in. long, having a ¹¹⁄₃₂-in. hole drilled to a depth of 7½ in., and a ¹¹⁄₃₂-in. hole the remainder of the way. We find at high speeds that the wood drill has a tendency to "balloon" out at the center, causing the hole to be too large, and that at lower speeds the drill follows the grain of the wood, thereby causing the hole to be crooked. May we ask that you give us your opinion as to the remedy for the trouble?

A. One of the machine-tool companies making deep-hole drilling machines for gun barrels informs us that it has experimented on the drilling of wood blocks with a small barrel drilling machine and has determined that the best results can be obtained on a production basis by using an ordinary twist drill and blowing the chips away with compressed air.

It is important that the drills be kept sharp, and that the wood block be revolved rapidly even though the drill is also revolving in the opposite direction. Furthermore, the end of the drill should be supported by a fixed bushing in order to start properly. If the wood block is revolved, the tendency of the drill will be to follow the center of revolution of the block rather than the grain of the wood.

Technical Abstracts

Skin Diseases from Lubricants

Oil rashes are of two kinds. The first is due to the plugging of the small glands at the root of the hairs on the arms and legs of workers, and the second comes from mechanical injury to the skin produced by metallic particles suspended in the cutting lubricant.

A mixture of oil and dirt in the cutting lubricant will block the minute openings of the root glands and set up inflammation around the hair. The inflammation commenced in this way may lead to suppuration, or abscess formation, known as a boil. If many hairs are affected the arm presents the appearance of a crop of raised red spots, or if the inflammation has gone as far as suppuration, yellow heads will appear.

Minute metallic particles suspended in the cutting lubricant may also produce slight injuries to the skin, which allow germs to enter and cause septic infection. Filtration is not sufficient to remove the particles of metal that injure the skin. Frequent cleaning of the machines with the removal of all of the old lubricant is essential. Washing accommodation for workers in contact with oil must be on a liberal scale. Workers should be instructed not to wipe their hands on rags before washing and to avoid washing their hands in the cutting compounds.—*The Machine-Tool Review* (Coventry, England), July-August, 1926, p. 79.

Success in Selling

It may be decidedly pessimistic to state that selling today is harder than it was ten years ago, but nevertheless it is my candid opinion that this is true. There are several factors that tend to make this condition. In the first place, the country is over-industrialized in many lines. This fact alone means overproduction, which condition eliminates the demand or starting point of all purchases.

Information regarding service rendered by purchased commodities is now being kept in a more intelligent manner by operating departments, so that records tell a more comparable story of the merits of various manufactured materials. The purchasing agent today is also a better posted individual than he was ten years ago. He is better acquainted with the uses of the commodities he is purchasing, and his superiors have often regulated his maximum expenditures by a budget system.

Finally, there is a vigorous propaganda at present toward reduced inventories. It is doubtful if we have ever experienced, except in times of real business depression, such endeavors as at present to operate with the minimum amount of raw material and finished supplies.

It seems to me that selling today requires more intelligence, more aggressiveness, and more enthusiasm than ever before. You must know your goods, and you must know your buyer. You must go into the customer's office prepared to convince him on the basis of a sincere, straightforward, honest statement.—Floyd Rose, in *Canadian Machinery and Manufacturing News*, Sept. 30, p. 28.

Buying in Small Lots

The struggle to make the other fellow carry the stocks of goods with all the attendant tie-up of capital has kept the manufacturers, wholesalers, jobbers, and retailers in a state of uncertainty throughout much of the last two years. The result has been hand-to-mouth buying. Such buying has apparently come to stay.

Formerly merchants bought their whole requirements for each season from four to six months in advance. They had to pay for them, store them, and insure them long before they were sold. On the other hand the manufacturer received his money early and ran his factory to capacity in rush times and curtailed during dull periods.

The merchant has found that by ordering in small quantities he can pay for his goods as he sells them, cut down rents, storage space and insurance costs, and avoid tying up his capital, at the same time getting the goods that he wants when he wants them.

The handling of this freight in less-than-carload lots has necessitated increased costs in handling, but the railroads have met the need through the use of unit containers, better organization at terminals, and the employment of motor trucks at terminals. Store-door delivery is becoming a fact in American transportation, and the railroads are finding it necessary to make delivery economical.—U. V. Wilcox, in *Timken Magazine*, Sept.-Oct., 1926, p. 635.

Measuring Short Time Intervals

The branch of applied mechanics that treats of the motion of projectiles, known as ballistics, has interested some of the greatest mathematicians of the past. Exterior ballistics treats of the motion of projectiles in free air, and is the basis of the art of gunnery. The theory is tested by practical experiments in order to eliminate errors, and for these tests certain instruments are necessary.

One of the most extensively used instruments for measuring the velocity of projectiles in air is one invented by Captain Le Boulenge of the Belgian artillery and called the Boulenge chronograph. It was further improved in this country. This instrument measures the time elapsed between the successive ruptures of two electric circuits. In front of the gun are placed two vertical screens upon each of which is stretched a wire carrying one of the two circuits. In passing through the screens the projectile successively breaks both of the circuits connected with the instrument.

The instrument is a delicate arrangement of electro magnets and recorders in which the exceedingly small time of functioning of the parts is taken into consideration in the calculations. Intervals of time measured are usually ten hundredths of a second, but the instrument can be used to measure accurately much smaller intervals of time.—Major A. W. Ford, in *Army Ordnance*, Sept.-Oct., 1926, p. 113.

Beware the Practical Joker

Everyone knows the pestilent "humorist" whose delight it is to pass out the explosive cigar. These so-called practical jokers are with us always, ready at every opportunity to cause annoyance, and to break forth into raucous laughter at the discomfort of the victim.

Machine shops, power plants, foundries, or all places where men work together, know the breed. They run up the range from the pest who delights in sending the apprentice for a left-handed monkey wrench to the fool who shouts at a nervous mechanic working in dangerous quarters.

If the practical joker were a hazard to himself alone, it would doubtless be desirable to encourage him; but he is not only a disturber, he is a constant threat of injury to all about him. Give the "practical joker" short shrift. Let him practice his avocation somewhere else other than in the shop.—*Oxy-Acetylene Tips*, October, 1926, p. 60.

Largest Testing Machine

A testing machine which is stated to be the second largest ever built, has been made by an English machinery manufacturer for testing the beams going into the Sydney Harbor arch bridge.

The machine has a load capacity of 2,800,000 lb., and has an internal length and width great enough for testing the built-up members 50 ft. long and 45 in. square. The testing machine uses hydraulic pressure for applying the load, and measures the load by means of a lever weighing system at the opposite head. The hydraulic plunger is 32 in. in diameter. The length of the machine is 120 feet.

Testing machines of greater power are in use at the U. S. Bureau of Standards, and at the Ambridge plant of the American Bridge Company, but the only machine of comparable dimensions is the 6,600,000-lb. machine at the Gross-Lichterfelde laboratory in Germany.—*Engineering News-Record*, Sept. 16, p. 468.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

A Plan to Kill a Goose that Lays Golden Eggs

ACCORDING to their plans announced at Detroit, the American Federation of Labor leaders are about to "organize the automobile workers regardless of jurisdictional lines."

Joy over this announcement probably will not be universal. Many of us have been able to buy automobiles and enjoy them because the prices have been steadily lowered through quantity production methods involving much modern machinery and unlimited individual effort. Among that group of car owners are a host of union men.

On the other hand, quite a few of us have been unable to afford homes because the construction costs have been steadily increased, largely through restriction of output under union rules. And some of us who have suffered this deprivation pay union dues.

In the automobile shops there are many operators who have become so phenomenally skillful that their piece-work earnings are high. Their reaction to union organization will be interesting.

One factor in the plan that will be met with joy by the consumer is the "disregard of jurisdictional lines." Every consumer has enacted the rôle of the injured innocent bystander in a jurisdictional labor dispute at some time in his life and he will watch with quiet satisfaction the struggle of the labor leaders with the jurisdiction octopus.

There are many uncertain things about this plan to organize the automobile workers but there is at least one sure thing—that many who now ride will walk if the plan succeeds.

The Bugaboo of Overhead

BUGABOOS are not discarded with toys and fairy stories and other childish things. Some of them stick well into middle age. And one of the great business bugaboos is overhead. Like inefficiency and other evils, overhead has been flung at our heads as an unmitigated evil. But there are cases where a lack of overhead is an unwarranted expense.

In other words, indirect labor, that we erroneously call non-productive, is frequently far more profitable than direct labor, assuming of course, that it is duly considered in setting prices, as it should be.

One shop that would show an unbelievably low overhead will suffice as an example. There is almost no office force. One draftsman does the detailing. The usual overhead, including office rent, is almost nil. An ideal condition—on the surface.

But someone must do the work of designing. So the owner and manager ties himself to the desk, which is always piled high with correspondence and drawings. Letters are answered when he can snatch the time from designing and bossing the shop. The bringing out of new machines is delayed and sales are lost because of it.

A little more overhead in such a case would pay big dividends in many ways. Too little overhead may not be more efficient than too much.

Power and Progress

POWER, as has frequently been pointed out, is a remarkably good index of a nation's progress. According to recent figures we generated 13,000,000 industrial horsepower in 1900. In 1925 this had grown to 55,000,000 horsepower, or over four times as much.

The use of electric current has grown from 2.5 billion kilowatts in 1900 to 68 billion in 1925, about 27 times as much. The growth in the last five years has been about 50 per cent.

A nation that utilizes mechanical power in such quantities has many advantages. It makes possible higher wages, low cost output and wide home markets.

The Modern Tool Dollar

MANY will consider the article by Chester H. Franklin as pure fiction and sarcasm. This, unfortunately, is not the case, as with a few exceptions, it practically represents the practice of at least one large concern building heavy machinery. And it isn't so far away from the practice of too many other shops as it ought to be.

We almost owe an apology to Messrs. Smith, Shaffer and others who have given us such splendidly constructive articles on the subject of machine equipment. Yet, we feel sure they will see how their methods shine in comparison.

There are many shops where depreciation and obsolescence seem to mean no more than to the Nameless Co. The managers entirely overlook the effect of new and more efficient machines on the value of their equipment. For even if a ten-year-old machine is as good as when purchased, it may easily be a liability instead of an asset when the production of a modern machine is considered. There is probably more self-deception regarding the condition and value of old machinery than in any other phase of shop management.

Shop Equipment News

Brown & Sharpe Surface Grinding Machine, No. 2

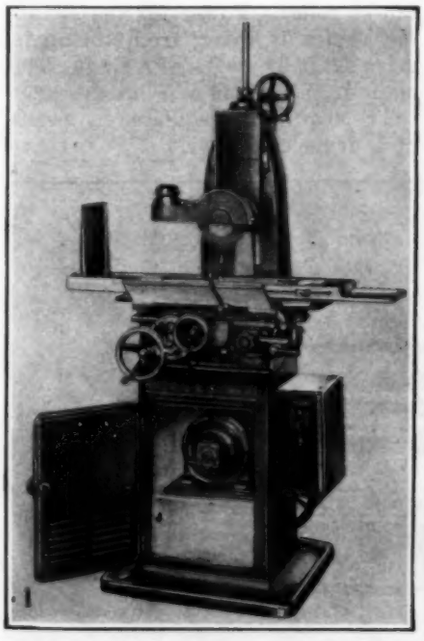
The Brown & Sharpe Manufacturing Co., Providence, R. I., has added to its line of "complete-unit" machines the No. 2 surface grinding machine shown in the accompanying illustrations. The motor is inclosed within the base of the machine, and in this position it is said to be completely protected from oil, water, dust, dirt and other sources of trouble to which motors located on brackets outside of machines are often subjected. This type of drive has proved to be desirable on this machine, as it provides a dependable drive in a compact and convenient form.

The motor, which is of the constant-speed type, is securely mounted on a plate which, in turn, is bolted to a shelf in an oil-tight compartment in the machine base. Ventilators cast in the door provide sufficient circulation of air to insure a cool-running motor. Additional space is furnished under the motor shelf for storage of attachments and machine accessories. Either direct or alternating current motors of standard makes can be furnished at the option of the customer.

The power is transmitted by means of a belt running over a system of pulleys. A tightener automatically keeps the belt in proper tension regardless of the height of the spindle head. Push-button control is provided near the operating position, beside the control box, which is located on the side of the base.

Longitudinal table travel and traverse movements are automatic, and the latter is provided with an automatic stop to throw out the feed at any desired point. When only the longitudinal feed is wanted, the power cross feed can be disengaged by means of a knurled knob on the front of the machine. All vital parts are completely covered by guards which serve to protect them from destructive abrasive dust, so that the life of the machine is not impaired.

Work up to 18 in. in length, 6 in. in width and 9½ in. in height can be accommodated with a wheel 7 in. in diam. The machine requires a floor space of 65x30 in., and its net weight without the motor is 1,350 pounds.



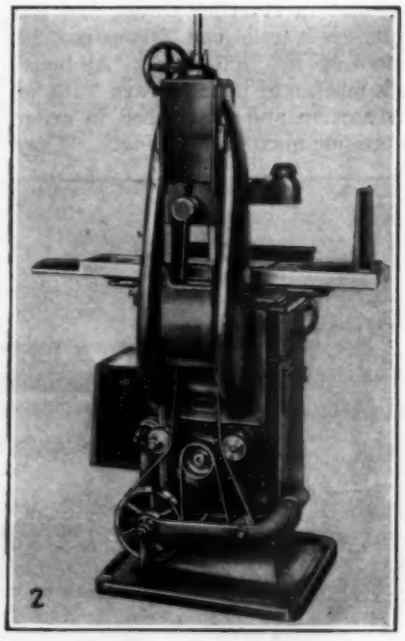
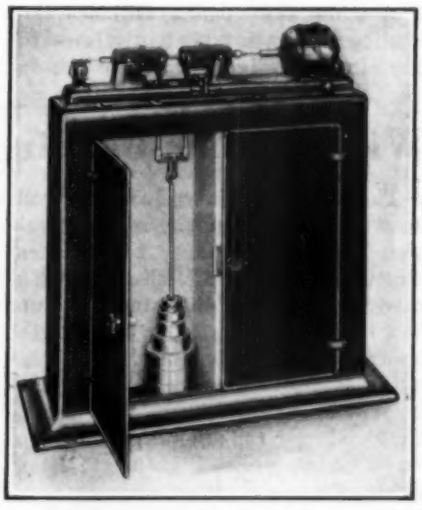


Fig. 1—Brown & Sharpe Surface Grinding Machine, No. 2. Fig. 2—Rear view of the machine

"Moore" Fatigue Machine

The Thompson Grinder Co., Springfield, Ohio, is marketing the R. R. Moore fatigue machine illustrated, for determining the resistance of metals to repeated stresses. The machine is of the plain-bearing type to insure quietness and to eliminate vibration. It has a permanent and accurate moment arm and employs a short and simple specimen of various lengths. Due to its special design, it is said to have unrestricted beam action.



"Moore" Fatigue Machine

The machine consists essentially of two light aluminum housings, each of which supports a rotating journal. The ends of the test specimen are attached firmly within a tapered hole in the journals. The housings are supported on fulcrum pins and serve as a mounting for the journal bearings, and also as a means of applying the load. The load is transmitted to each housing through a hanger yoke, the ends of which are fitted with knife edges to rest in the vee blocks mounted on the housing. To the bottom of the yokes are attached hanger arms, which are joined

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at their lower ends by an equalizing bar, from the center of which the load is hung. The load is built up in units of ten pounds and fractions, all accurately calibrated. They are of a special design to facilitate the operation of loading the specimen, and can be easily seen through the opening in the lower part of the machine.

The base upon which the machine is mounted is a heavy cast-iron cabinet with doors. Its weight helps eliminate vibrations transmitted from surrounding machinery. The closed doors hide the weights from view and protect them from being accidentally disturbed during the test. One side of the cabinet is fitted with shelves for keeping test specimens, and with compartments for tools. The other side, which encloses the loading device, is sufficiently large to contain the weights that are not in use. The construction of the machine permits a variation in length of the test specimen from 1 in. longer to 1 in. shorter than the standard. This variation requires no change in the load calculation or in the method of setting up. The load is applied in such a manner that the bending moment is uniform over the entire specimen; the test automatically seeks out the weakest location, regardless of the shape of the specimen. Calculation of the necessary load for any desired stress is reduced to a single multiplication by means of a table supplied with the machine.

Each machine is provided with an automatic throwout switch, so that when the specimen breaks the motor is cut out. A recorder counts the cycles of stress passed through up to the instant of rupture. This instrument is also automatically cut out when the specimen breaks.

Wickes Plate-Bending Roll, Medium-Duty

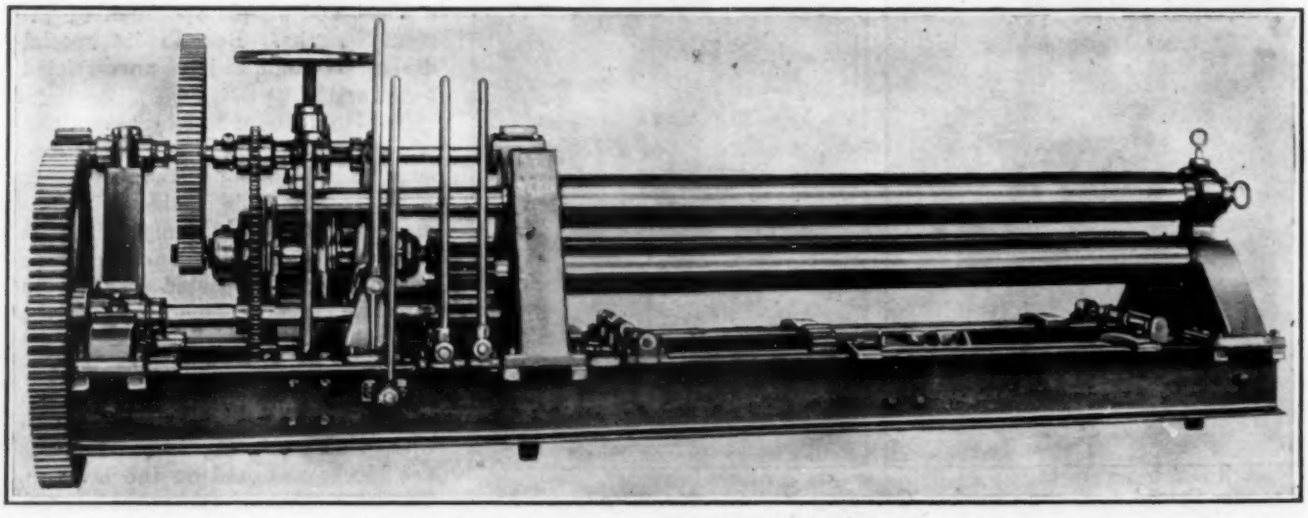
The medium-duty bending roll shown in the accompanying illustration is being made by Wickes Brothers, Saginaw, Mich. It has a capacity of rolling mild steel plate up to ¼ in. in thickness by 6 ft. in length to a circle 24 in. in diam. The machine is of the pyramid type: the rolls are arranged in pyramid form, the two lower rolls being gear driven and the upper roll being friction driven from the plate.

The rolls are open hearth steel forgings, the top roll being 6 in. in diam. and the bottom roll 5½ in. in diam. The top roll has an extension arm or balance bar with an adjustable supporting shoe for holding the top roll in position, while the removable bearing at the tail end has a knockdown housing so that plates rolled to complete circles may be easily and quickly removed. Shallow grooves are placed in the lower rolls to assist in starting plates, and the front lower rolls can, if desired, be slotted for use in flanging. All housings and main brackets are built of box section and are ribbed in order to provide maximum strength. They all are made from semi-steel castings.

All gears have teeth cut from the solid and are double shrouded to the pitch line. Each lower roll has its own independent driving gear and pinion. The journals are staggered so that the rolls can be placed close together in order to bend the plates close up to the edge. With this construction, a large diameter driving gear and pinion can be used so that the resulting tooth pressure is reduced.

The frame of the machine is constructed of heavy structural steel, designed to be mounted on a concrete foundation with the bolts running through the frame and foundation. Structural steel has been chosen in place of the usual cast iron in order to prevent breakage under overload: under such circumstances it is said that this type of frame will deflect but will not snap.

The upper roll can be raised or lowered by means of a power device, which has spur friction gears as the initial drivers. In case of overload, the friction gears slip and the machine is not injured. Forged steel screws with buttress type thread transmit vertical motion to the boxes. Clutches are provided for each elevating screw so that either end of the upper roll may be raised or lowered independently of the other end, so that plates of conical sections can be rolled. Power for the elevating device is taken from the main drive shaft by means of a chain. The main drive is from a 7½-hp. bending-roll type of motor regulated by means of a drum controller.



Wickes Plate-Bending Rolls, Medium-Duty

Shop Equipment News

Racine "Shear-Cut" Production Saw

The Racine "Shear-Cut" Production Saw for high-speed metal cutting is being built by the Racine Tool & Machine Co., Racine, Wis. in 4 models; 2 belt-driven models with single and with three speeds, and two motor-driven models with single and with three speeds. By means of an automatic screw-feed mechanism, the saw is progressively drawn or fed into the metal at a certain speed accurately predetermined for each size of stock. The adjustment for various speeds can be easily and quickly made. Because the saw is brought down positively, it is claimed that each tooth gets its share of the load, which is uniformly distributed throughout the cutting strokes. All teeth enter into the cutting action and no one tooth takes more than its predetermined depth of cut. The machine will cut a bar of cold-rolled steel 4 in. in diameter in 4 min. for the first cut and in the same time for the hundredth cut, with the blade still left in good condition.

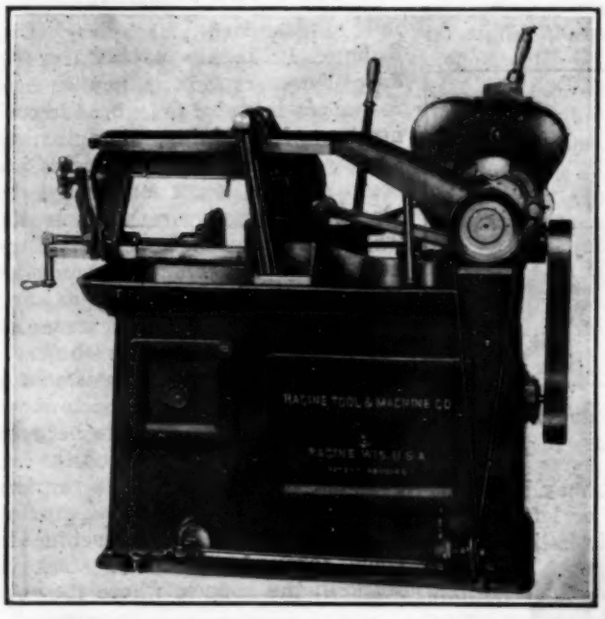


Fig. 1—Racine "Shear-Cut" Production Saw

With this method of graduated feeding during the entire cutting stroke it is said that undue blade pressure is positively eliminated. The metal is removed as fast as the saw is fed down. It is further claimed that at no time does the blade bow or buckle and reinforcement on top of the blade is not necessary, nor does the blade have to be stretched under heavy tension in order to keep it straight. A standard blade 1 in. in width is used.

In Fig. 2 the positive lifting and feeding mechainism is shown. A circular roller shown in the center of the illustration keeps the upper and lower rollers in continuous engagement with a cam on the main shaft. The turning of this cam causes an absolutely positive rise and fall movement to the carrier, and by means of direct-lever connection with the feeding screw and saw frame, the blade is caused to lift away from the work on the non-cutting stroke, and is applied positively to the work on the cutting stroke. The double-arm saw guide has two bearings on the main shaft and is of such proportions that a straight-line pull is maintained on the blade without any side drag. The saw frame is carried in V-guides in the carrier frame, which has a ground taper gib with one adjusting screw. The V's are widely spaced. It is said that the upward pressure on the saw automatically centers the blade at right angles to the stock.

The cam on the main shaft operates a radius arm with an adjustable lever sliding therein to give feeds as desired by the operator. A range of cutting speeds and feeds are available for cutting such materials as piping, tubing, and other solid metals. The feed is determined by the size of the stock to be cut and is selected by placing the lever in the proper notch in the radius arm. A plate on the machine indicates the proper speed and feed for each class of work.

After the cut is finished, a clutch is automatically thrown out and the feeding device is released. The saw guide can then be reset in any desired position. This guide is balanced so that it holds itself at any height thus permitting the operator to use both hands in resetting and gaging stock for the next cut. The saw is again started by throwing in the clutch, after which it feeds itself automatically into the work.

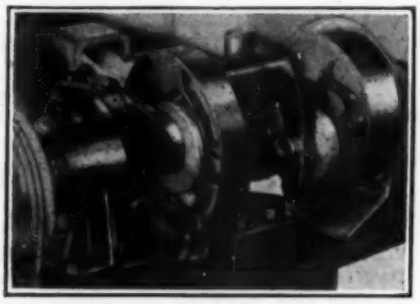


Fig. 2—Positive lifting and feeding mechanism

Where it is necessary to cut a variety of metals such as cast iron, tool steel, alloys and other stock of different degrees of hardness, it is recommended that the three-speed transmission be used. This transmission is mounted directly upon the main shaft and provides speeds of 130, 90 and 60 strokes per minute.

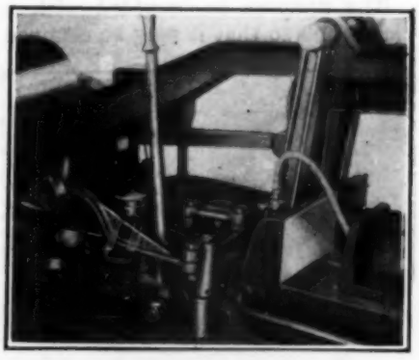


Fig. 3—Adjustment for speed mechanism

It is combined with a worm-gear motor drive as a single unit.

The rated capacity for all four models is 6 x 6 in. although 6⅝ x 6⅝ inch stock has actually been cut. The stroke is 6 in., and blades 10, 12 and 14 in. in length can be used. With motor drive, a 1-hp. motor at 1750 r.p.m. is supplied.

The machine occupies a floor space of 30 x 50 in. Its over-all height is 44½ in., while the height to the top of the table is 24½ inches.

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"Standard" Rotary Swaging Machines

The Standard Machinery Co., Auburn, R. I., has brought out a line of rotary swaging machines for which several improved features are claimed.

The machines are now built with a cabinet base which is adapted to receive the driving motor, thus making the machine self-contained, more rigid, and reducing the floor space necessary to accommodate an independently driven machine. An adjustable idler maintains the tension of the belt.

The spindle runs in long, heavy bronze bearings that are easily renewable. Lubrication is by means of wick feed from reservoirs cast in the frame of the machine.

The spindle and die-head is one piece, made of steel and hardened and ground all over. The slot in the die-head is lined with hardened and ground strips of tool steel that are renewable, and the inner side of the retaining door on the frame is faced with hardened steel, which is also replaceable, so that the dies and hammers are entirely inclosed by hardened and renewable wearing surfaces.

The flywheel is provided with a clamp hub so that it may be clamped tightly over the key by means of two bolts, and thus secure it from working loose under the continual jarring of the machine.

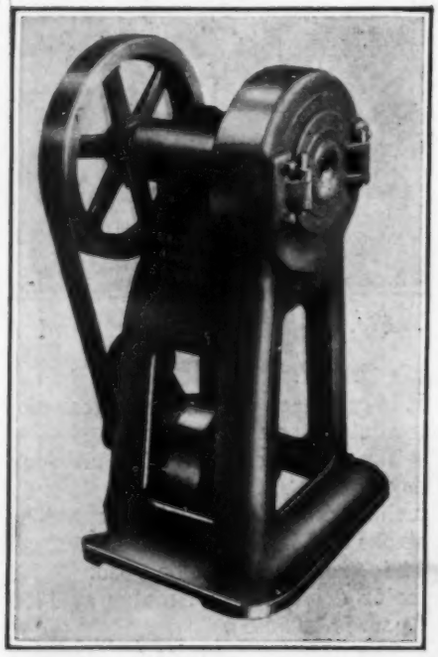


Fig. 1—"Standard" Rotary Swaging Machine

The roll-cage is a steel forging and is provided with an annular cover to confine the rolls, so that it may be removed from the machine as a unit by opening the swinging door on the frame. This cover is secured to the cage by means of flush-head bolts.

The door that confines the roll-cage, dies and hammers is secured to the frame by a taper-pin hinge on both sides, so that it may be swung open either to right or left, according to which taper pin is lifted from its hinge.

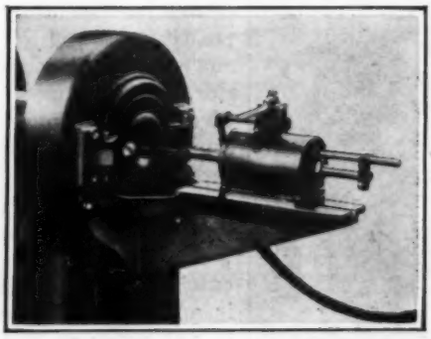


Fig. 2—Pneumatically-operated fixture

The machine is regularly built in nine sizes ranging from ⅛ to 6 in. for tubular work, or from ⅛ to 3 in. for solid rods. Any of the machines may be made with a water-jacketed head if intended to be used for hot swaging.

The largest machine weighs 15,000 lb. and occupies a floor space of 51x60 in. The smallest machine weighs 140 lb., and a floor or bench space of 17x18 in. is sufficient to accommodate it. Fig. 1 shows the No. 2A machine.

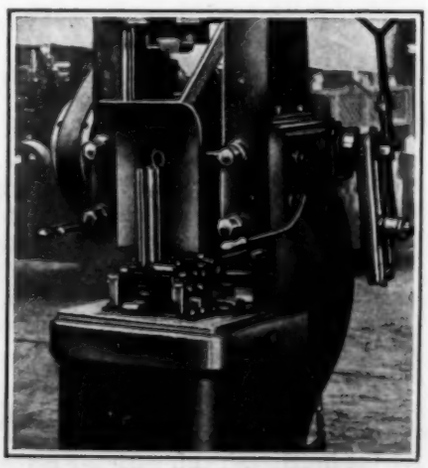
All machine frames now have finish-pads on the front for the purpose of attaching brackets for work-holding or handling fixtures. In Fig. 2 is shown a pneumatically operated fixture that is regularly supplied for any of the machines. This fixture may be obtained with any desired length of stroke, though the 6-in. length is standard and regularly carried in stock. The work-holding arbors of the fixture are interchangeable to accommodate different sizes and kinds of work.

The fixture is adjustable along its bracket to accommodate work of different lengths. Adjustable stops on the arbor provide for uniform length of the swaged shoulder when the fixture is once set. Provision is made for an air blast to be directed upon the dies for the purpose of removing scale or dirt during the swaging operation.

"Standard" Automatic Feed for Drop Hammers

The Standard Machinery Co., Auburn, R. I., has devised for its drop hammers an automatic feed movement intended to be used in connection with coining, stamping, or similar work wherein the pieces are comparatively small and must be placed individually on the lower die. This feed relieves the operator of the necessity for placing his hands at any time in the danger zone, and does away with the major cause of accident on this class of machinery.

The feed movement consists of a carrier, or pair of carriers, to move across the face of the die between the magazine, or hopper, and the impression in the die. These carriers are actuated by a positive cam on the back-shaft of the machine to come forward under the stack of work in the hopper, where they receive the bottom piece of work; carry that piece to the die and deposit it in the impression; and then separate to avoid the blow of the hammer.



"Standard" Automatic Feed for Drop Hammers

As the hammer rises after striking

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the blow, the carrier again picks up the work piece and sweeps it off the die at the back, after which it again comes forward to receive another piece from the stack.

A shield, or guard, of heavy sheet metal covers the greater part of the space between the guide-ways below the hammer in its raised position, so that it is practically impossible for the operator to get his hands in a position where they could be injured. His sole duty is to keep the hopper filled with the work-pieces.

Rockford Drilling and Boring Machine

The Rockford Drilling Machine Co., Rockford, Ill., is marketing a drilling and boring machine that can be made to serve many applications by interchanging certain standard parts. It is for high production work and has been designed with the idea of simplicity and a minimum of working parts. All drive-gear boxes on the base of the machine have been eliminated and the motor drives directed to the head through a worm and gear unit. The drive is arranged with interchangeable pick-off gears for obtaining speed changes.

Both a single- and a double-speed machine is made, and the latter is controlled by means of a lever. In the single-speed unit six gears are used in the drive, while eight gears are used in the drive for the double-speed machine. An additional reverse speed for such operations as tapping can be obtained by merely adding one more gear, making nine gears in all on the drive. All shafts and revolving parts in the gear box are mounted on taper roller bearings which carry both the radial and thrust loads.

The front part of the head contains the spindle unit and is so designed that it can be removed or replaced by another at any time. The spindles rotate in bronze bushings mounted on either side of the spindle gear. The thrust of the drills is taken on ball thrust bearings. Almost any combination and number of spindles required can be arranged for, provided that the centers are not so close as to reduce the spindles and gears below the size necessary to take the load. These spindle units are made with fixed centers only.

The entire head carrying the drive and the spindle unit is fed on ways on the base of the machine by means of an Oilgear pump and cylinder. This feed can be arranged for either hand or automatic control depending upon the particular job. With the Oilgear type of feed, slow feeds as well as rapid traverse in either direction can be obtained, and it is possible to provide for any reasonable length of travel. This type of head can be mounted either on a horizontal base as shown in the illustration, on a vertical column, or on angular columns. The base can be arranged for a head on one end, or heads on both ends. Combined horizontal and vertical heads can also be obtained.

In the illustration a stationary type of work table is shown, but a round indexing type, having a pivot at its center, or a cross sliding type can be furnished to suit the particular requirements.

This machine is made in several sizes so as to cover a wide range of requirements from light to heavy work. All parts are made of high-grade steel, heat-treated where necessary, in order to give longer life. The workmanship is said to be good.

Apex Chucks and Tool Holders

The Apex Machine Co., Dayton, Ohio, is marketing several improved chucks and tool holders shown in the accompanying illustrations.

In Fig. 1 is shown a safety tool holder for use in reaming, spot-facing, and counter-boring operations and also for tapping. In general, it may be used with any tool that is likely to stick and break. The device may be used for tapping pipe threads, and by setting the friction to the desired amount, the operator

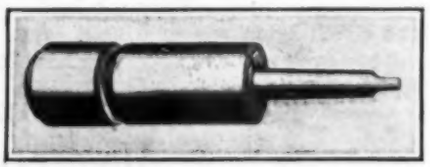

Fig. 1—Apex Safety Holder

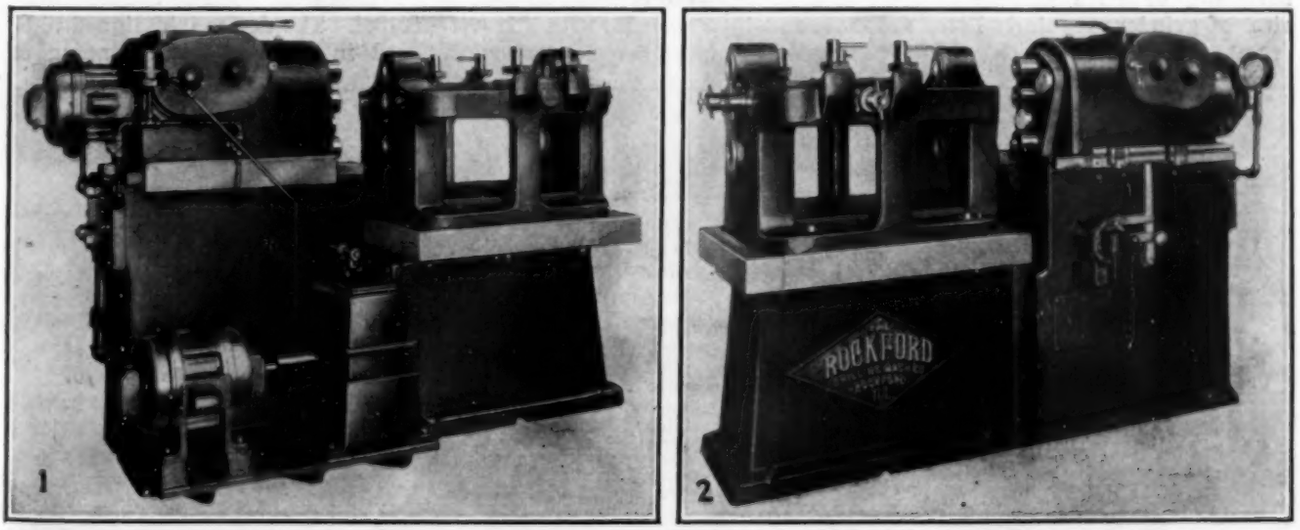

Fig. 1—Rockford Drilling and Boring Machine, rear view showing Oilgear Pump. Fig. 2—Front view

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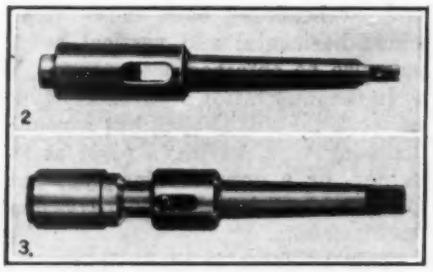


Fig. 2—Apex Close-Center Chuck
Fig. 3—Vertical-Float Tapping Chuck

can tap the holes to uniform depth, since the holder will slip when the proper depth is reached.

The close-center chuck shown in Fig. 2 may be used for drilling holes at close center distances. The outside diameter of the shank can be supplied as desired, ½, ⅝, ¾, or 1 in. in diameter, while the shank is furnished in Nos. 1 and 2 Morse taper. It is made of cold-rolled steel, hardened and ground. Straight-shank drills can be used. They are held in the chuck by means of a split taper bushing, which is released by means of a taper key driven through a slot in the chuck in the usual manner.

In order to eliminate the crowding of taps and to compensate for taps having different leads or uneven starting, the vertical-float tapping chuck shown in Fig. 3 has been developed for use on multiple-spindle tapping machines. It has ½-in. vertical float and is made in two sizes for handling standard taps up to ⅜ and ¾ in. respectively. It is furnished with friction-drive holders for bottom tapping. The lower part of the device is the standard Apex positive-drive tapping chuck, while the upper part is an adapter to fit the machine spindle. By means of a drive pin held in the chuck shank by means of a set screw, the adapter drives the chuck. The float is regulated by means of a tension spring. Taps are held in the chuck with Apex quick-change tap collets, both the tap and the collet being driven by the square. The unit is made of alloy steel, hardened and ground.

"Hanchett" Grinder with Walker Magnetic Chuck

The surface grinder equipped with a Walker magnetic chuck shown in the accompanying illustration has been placed on the market by the Machinery Company of America, Big Rapids, Mich. The machine is designed for grinding locomotive guide bars, shear blades, or for any general surfacing or edge grinding. The sizes of grinders regularly listed are from 84 to 192 in., with width of grind up to 12 in., but machines of larger capacities are built on order.

One of the features of the machine is the traveling wheel and stationary work table. With this arrangement the machine is required to be only slightly longer than the work, and it is claimed that only half of the floor space is required that is taken up by a machine with a travelling work table. The shorter length of design permits a more massive type of construction. It is claimed that with the work held on a stationary and rigid table a greater accuracy in grinding is obtained. It is also maintained that the machine with traveling wheel requires considerably less power for operation than the type with traveling table.

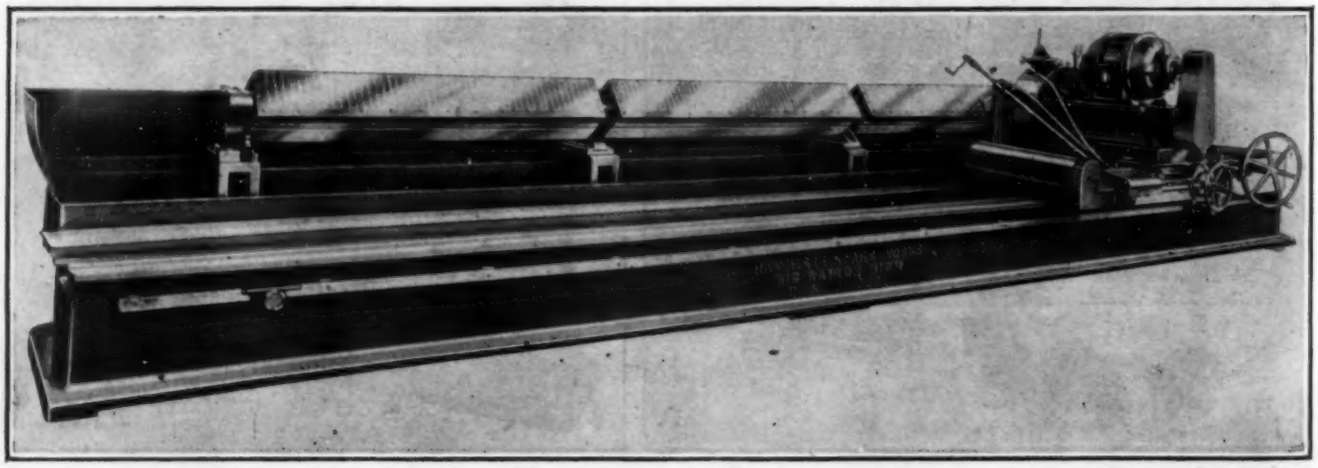
The traveling wheel carriage is driven by means of a train of steel gears which are automatically lubricated from an oil reservoir in the carriage. This reservoir also lubricates the ways on the bed. The grinding wheel arbor is 4 in. in diameter, and is mounted on ball and ball-thrust bearings. A silent chain from the motor drives the arbor. The traveling carriage is traversed either by hand or power, and is controlled from the front or the rear of the machine.

The grinders are equipped with 24-in. or 30-in. wheels with abrasive segments. A wheel truing device is fastened to the upper wheel guard of the machine so that the wheel can be trued easily while grinding. The machine is equipped with an automatic feed control.

The machine shown in the illustration is a special size, 220-in. capacity. It occupies a total floor space of 25 ft. 8 in. by 6 ft. 6 inches.

Porter-Cable "Take-About" Hand Sander

The Porter-Cable Machine Co., Syracuse, N. Y., is marketing the "Take-About" hand sander illustrated. The device is designed to be used in place of hand sanding or



"Hanchett" Grinder with Walker Magnetic Chuck

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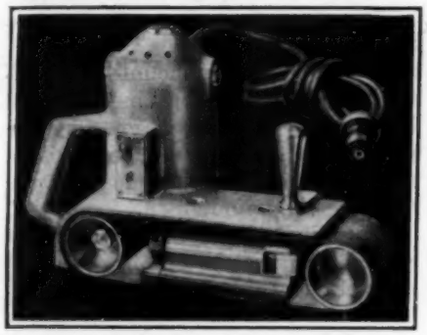
polishing on wood or metal surfaces. It is shaped like a hand plane and its method of operation is somewhat similar. Concave or convex surfaces as well as flat surfaces can be finished since the shape of the block over which the belt travels determines what form the belt shall take.



Porter-Cable "Take-About" Sander

A flat hardwood block is regularly furnished with the machine, but it may be quickly changed for blocks of other shapes to suit the requirements of the operator. When the flat block is used it is said to be impossible for the surface to become wavy when the machine is used in its ordinary position, because the pulleys do not come in contact with the work. However, for sanding interior curves of diameters larger than the diameter of the front pulley, which measures 2¼ in., the sander may be tilted or lifted into the proper position. For grinding or polishing large metal surfaces, the machine may be equipped with a flexible pad in place of the regular solid form block, although this is not always necessary.

The device is constructed so that the right-hand side is clear and the belt is thus allowed to sand close up to the baseboard on floor work, so that no subsequent hand work is necessary. A supporting frame has also been designed to fit the machine when it is turned on its side. In this position it can be used as an edge sander and also as a tool grinder, and for removing burrs and surplus stock on small wood or metal parts.

The entire frame of the machine with the exception of the motor cap is a one-piece aluminum casting. The motor cap and pulleys and all other parts except a few necessary bronze and steel fittings and the form block itself are also made of aluminum. Since it weighs only about 12 lb. it can be readily lifted about without tiring the worker, and from this feature it obtains its trade name.

It is equipped with a ⅓-hp. universal motor and may be used on any alternating current from 25 to 60 cycles, or on direct current of 110 volts. Motors for use with 220-volt circuits can be supplied on request.

Belts are furnished for cutting both wood and metal or for either substance separately. It is said that the belts can be changed in a fraction of a minute. An aluminum guard, which is part of the frame, protects the hand from the belt and at the same time eliminates possible trouble from dust.

Other features include precision ball bearings throughout, and a small fan on the motor for air-cooling purposes.

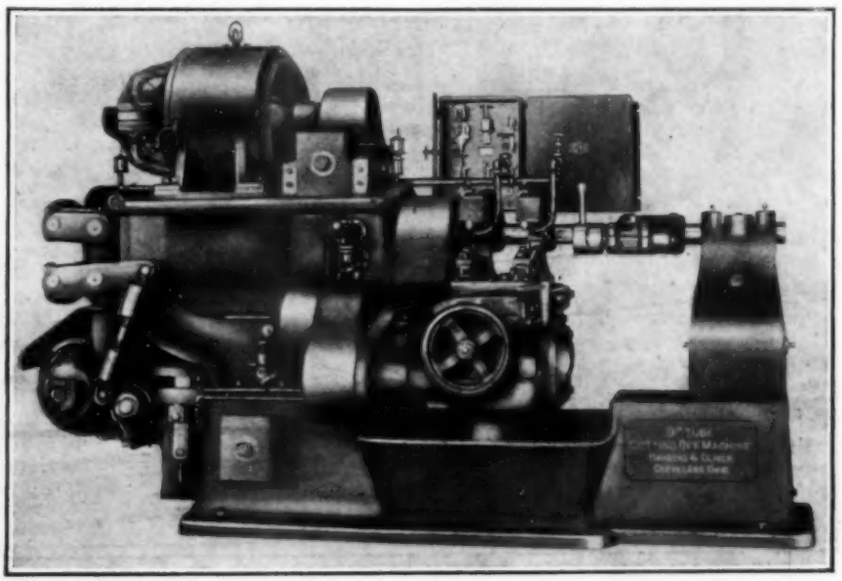
Bardons & Oliver Cutting-Off Machine 8-Inch

The 8-in. cutting-off machine shown in the accompanying illustration is being built by Bardons & Oliver, Cleveland, Ohio. It is designed especially for production work on both thin- and thick-wall steel tubing and bars.

Two cutting-off tool slides are provided; one at the front and one at the rear. They travel on a heavy saddle mounted directly on the front end of the head, so that an unobstructed passage is left for chips and lubricant to fall into the pan beneath. The power feed is engaged by the operator's right hand, while the air chuck closing the collet is operated simultaneously by his left hand. The cut-off slides then feed in automatically, and at the end of the cut quick-return motion brings them back to the starting position. The slides are sufficiently wide to carry one, two, or more tool holders, both front and rear, so that several pieces, depending upon the length, can be cut off at the same time. The illustration shows double tooling for cutting off two pieces at the same time.

The collet, which is air operated, is of the hinged type, which is said to be durable. The false jaws for the different sizes of stock are readily changed without removing the collet from the spindle. Its opening and closing is controlled by a four-way valve conveniently located on the front of the head.

The same motion that opens the collet brings the feed rolls into contact with the stock. The roller-feed gear train is driven by a variable-speed reversing motor, so that the rate and direction of feed of the stock can be readily controlled. Swinging on a bar at the rear of the machine is the stock stop, which drops in place to gage the stock and



Bardons & Oliver Cutting-Off Machine, 8-Inch

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automatically withdraws after the chuck is closed and the machine is started.

A chamfering attachment can also be furnished when desired. The arms that carry the cutters are attached to the same bar as the stock stop, and are operated simultaneously with the cutting-off tools by means of a second air cylinder located on the pedestal at the right-hand end of the machine.

The driving motor regularly applied to this machine is rated at 15 hp. It has a speed range of 3 or 4 to 1, depending upon the nature of the work. The roller feed motor is rated at 2½ hp., and has a speed range of 2 to 1. It is provided with a reversing-type controller. A constant-speed motor, rated at ½ hp., drives the coolant pump. The machine occupies a floor space of approximately 62x124 in. Its shipping weight, with motor, is about 15,000 pounds.

Other machines are furnished in 6-, 10-, and 14-in. sizes. The driving motor of the 6-in. size is 15 hp., while those of the 10- and 14-in. sizes are each 20 hp. The feed and pump motors remain the same. The floor space occupied is respectively 62x124 in., 62x134 in., and 67x140 inches.

Hoefer Horizontal Drilling Machine Special-Purpose

The Hoefer Manufacturing Co., Inc., Freeport, Ill., has developed a horizontal drilling machine for use in drilling the oil holes through the throws of large and heavy crankshafts such as are used on Diesel engines. For this class of work the size and weight of the shafts are such that it is practically impossible to move them from position to position under an ordinary drill. Hence this unit is designed to be movable along a base or bed.

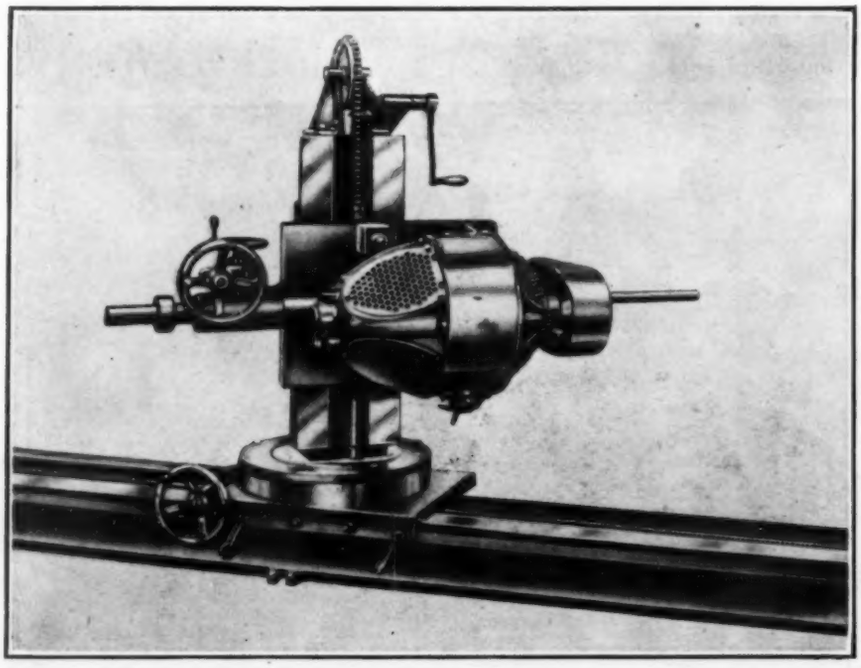
The bed is long enough to give ample horizontal travel to the column to reach the full length of the crankshaft at one setting. The head of the machine is bolted to the floor plate by means of three ears on each side, the middle one of which can be seen in the illustration. The two other ears are located at the ends of the base respectively. On the base is mounted a cut steel rack running the full length of the base, and by means of a handwheel shown on the saddle, the column can be easily and quickly moved to any desired position. The saddle has a scraped-in fit on the ways of the bed and it can be locked in any position by means of clamps.

The column has a swivel bearing on the saddle so that the entire upper unit can be turned to drill oil holes at any angle. The clamping arrangement is said to be ample so that when in use the column and saddle act as a single piece.

On the column is mounted a counter-balanced, self-contained head upon which is carried the motor with pick-off gears. Ample speeds within the limits of the requirements of the machine can be obtained.

The spindle and spindle quill are of such a length as to obtain a feed of 20 inches. In order to reduce friction to a minimum, the spindle is mounted on ball bearings. The head has a vertical adjustment of 12 in. on the column, and its travel is controlled by the crank shown on the upper end of the column.

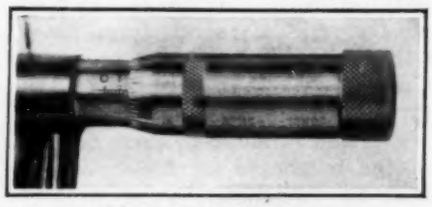
The length of the bed can be furnished to suit any length of shafting being drilled. All parts are made of ample proportions, and it is said that the material has been selected to suit the particular requirements of each part.



Hoefer Horizontal Drilling Machine, Special-Purpose

Slocomb Micrometer Graduated to 0.0005-In.

The J. T. Slocomb Co., Providence, R. I., has arranged to furnish the thimbles of any of its standard micrometers with 50 instead of 25 graduation marks on the beveled edge, so that a line-to-line reading may be made to one-half thousandth of an inch instead of to a full thousandth as formerly.



Slocomb Micrometer

The advantages claimed for the new marking are that the matching lines are always directly before the operator's eye as he holds the instrument in a natural position, and that he is enabled by the closer spacing to judge quarter-thousandths more accurately, as the latter measurement is represented by bringing the vernier line half-way between two graduation marks upon the thimble.

Trade Catalogs

Ball Bearings for Electric Motors. The Fafnir Bearing Co., New Britain, Conn., has issued a bulletin describing the advantages of using ball bearings on electric motors. They are summarized as follows: Economy; greater dependability; maintained air gap; no shorts from oily windings; capacity for thrust loads; reduced maintenance costs including savings in labor, repairs, and lubricants; shorter over-all length; and ability to be mounted in any position without leaking oil. The booklet contains thirty-two 5½x8½-in. pages and is well illustrated.

Die-Making Machines. The Oliver Instrument Co., Adrian, Mich., has issued a 12-page, 8½x11-in. pamphlet describing its various types of die-making machines. The machine files, saws, and laps with abrasive stones. The construction of the various types of machines is explained in detail supplemented by illustrations. Eight different sizes of machines are mentioned in three different types. Complete specifications are given in each case.

Drill Grinder. The Oliver Instrument Co., Adrian, Mich., has published two 8½x11-in. pamphlets on its drill pointer and point-thinner machines for grinding twist drills automatically. Complete technical descriptions of the tools are given, and the text is supplemented by illustrations.

Forging Machines. The National Machinery Co., Tiffin, Ohio, has issued Talk No. 59 entitled "Making Automobile Socket Wrenches on the Forging Machine." A brief description of the manufacture is given and the illustration pictures a complete set of the dies necessary.

Gears. The Horsburgh & Scott Co., Cleveland, Ohio, has published an 80-page, 6x9-in. pamphlet entitled "Blue Book on Gearing." Rawhide gearing is discussed in the first 32 pages. Its advantages and adaptability are described, then its manufacture. A page of "Don'ts" is also given. The remainder of the booklet is devoted to metal gearing. Helical, herringbone, spiral, and worm gears are taken up in turn. Much useful data and tables on tooth forms are presented, and rules for calculating spur and bevel gears are given. Some useful general tables are also appended. The booklet is well illustrated and should make a valuable reference work on this subject.

Gear Problems. Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill., has published general catalog No. 200 entitled "Gear Problems and IXL Speed Reducers." It contains over six hundred 5½x7¾-in. pages and is a veritable hand book on gear and general engineering subjects. The entire line of IXL worm, spur, and herringbone speed reducers, couplings, bases, and industrial gears of every size and kind are listed with ratings and dimensional data. Several hundred pages of engineering information, data, tables, and formulas on conveying machinery, spur, bevel, mitre, internal, helical and herringbone gears, worm gearing, and rawhide gears, sprockets and chains, and general mathematical tables and formulas are included. The book is indexed by subject in the upper page corner for easy reference, and has in addition a very complete cross reference index in the back. It is well illustrated throughout.

Heating, Industrial Unit. The Buffalo Forge Co., Buffalo, N. Y., has issued catalog No. 466, entitled "Industrial Heating with Buffalo Unit Heaters." The booklet contains twenty-four 8½x11-in. pages and is well illustrated with line cuts and halftones. Various types of heaters are described and specifications and dimensions are given. Typical layout plans are given supplemented by photographs of installations in various types of plants.

Indicators, Dial. The Commercial Tool Co., 2026 East 22nd St., Cleveland, Ohio, has issued a pamphlet on the dial indicators and gauges made by the Federal Products Corporation, Providence, R. I. Each type of instrument is illustrated and a brief note is made of its specifications.

Motorized Power. The General Electric Co., Schenectady, N. Y., has issued a 12-page pamphlet under the above title. In it is discussed electric locomotives, electric tractors, electric trucks, cranes, and other handling devices. The bulletin is well illustrated with a large number of typical installations.

Rebuilt Tools. Morey and Company, Inc., Broome & Lafayette Sts., New York, N. Y., has issued a rather complete catalog on the rebuilt tools that it has in stock. The booklet contains thirty-two 8x9-in. pages, and nearly every type of machine tool is listed. Under each classification, such as milling machines, plane, vertical, horizontal, etc., at least one illustration is given. Over fifty types are classified. The catalog is indexed.

Screw Threads. The Rickert-Shafer Co., Erie, Pa., has published a wall chart mounted on stiff paper, hinged in three parts so as to be compact for mailing, that contains data on design and manufacture of threaded parts. National coarse-thread and fine-thread series are given, together with National standard pipe threads. The information is taken from the Simplified Practice Code issued by the Department of Commerce. Brief notes on Tables 2, 3 and 4 of that code are also included. The purpose of the chart is to educate manufacturers and designers to use standard sizes of thread with a view to economy in sizes and chasers.

Shutters and Doors, Steel Rolling. The Cornell Iron Works, Inc., 71 Marion St., Long Island City, N. Y., has published a 32-page, 8½x11-in. catalog on its steel rolling shutters and doors. Complete specifications and descriptions of each type of door are given, and the details of construction are brought out by means of line cuts and photographs. Over fifty typical installations are also illustrated.

Stampings—Erratum. On Page 620, Vol. 65 of the *American Machinist*, the Detroit Stamping Co., 3445 W. Fort St., Detroit, Mich., was listed as manufacturers of dies for stampings. The die sets listed in its general folder No. 12 are available for the manufacture of special washers, but the dies themselves are not for sale.

Steel, Special and Alloy. The Jessop Steel Co., Washington, Pa., has published its general catalog for 1926. Carbon tool steel, high-speed steels, and various alloy steels for forging and die work, ball-bearing steel, stainless steel, rustless iron and magnet steels are briefly described in turn. Instruction in forging, annealing and hardening the steel is given in each case. Saw steels, cutlery steels, and special steels for automobile and airplane construction are also listed. Many useful tables are appended. A concise technical discussion of the principles of heat-treatment is given in the last 18 pages. The catalog contains seventy-two 4½x7-in. pages. It is attractively presented with small sketches on each page to enliven the text.

Welding, Arc. The Lincoln Electric Co., Cleveland, Ohio, has issued a 24-page, 8½x11-in. pamphlet on its automatic arc welding equipment. The general principles of welding with the "Stable-Arc" machine are first enunciated. A brief description of the principal parts is given. Such questions as how the arc joins the steel, and why the carbon electrode process is used, are answered. A table of welding speeds and costs is also given. Various types of equipment are shown, and numerous examples of typical jobs are presented. The booklet is well illustrated by means of photographs and line cuts.

Pamphlets Received

How to Make an Inexpensive Storage Oven. The Plumbago Crucible Manufacturers' Publicity Bureau, Room 1506, 90 West St., New York, has issued a small leaflet under the above title. The first page is an extract from an editorial in *The Metal Industry* of May 1925, entitled "The Crucible Situation." The construction of a storage oven for crucibles is then described, followed by a discussion on the storing, drying and annealing of crucibles made of plumbago. The bulletin is illustrated.

Stay-Bolt, Engine-Bolt, and Extra-Refined Wrought-Iron Bars. Industrial Standards No. 64, issued by the Department of Commerce and sold by the Superintendent of Documents, Government Printing Office, Washington, D. C., for 5 cents. The text is printed in both Spanish and English, and consists of the standard specifications for stay-bolt, engine-bolt and extra-refined wrought-iron bars as adopted by the American Society for Testing Materials. Specifications for manufacture are given, followed by a list of chemical and physical properties and tests.

News of the Week

Gary Pleads for Stricter Application of Golden Rule in Steel Industry

Scouts idea of competition with foreign producers

In his annual address before the thirtieth general meeting of the American Iron and Steel Institute, held in New York on Oct. 22, Elbert H. Gary, president of the organization and chairman of the United States Steel Corporation, made an eloquent plea for better business relations in his industry and also in all industries, large and small, in this country.

Judge Gary covered various topics of interest to the steel industry, but he laid particular stress on the necessity for the continued effort to further better relations between units in the steel industry itself, and between those units and their contacts outside.

"It is appropriate to congratulate ourselves and each other on what the iron and steel industry of the United States has accomplished during the last twenty years or more in the direction of conciliation and co-operation," said Mr. Gary. "Everyone present will remember the days when the steelmasters of this country were engaged in industrial war; when the hand of the steelmaker was raised against his brother; when practically, in the steel business, might made right; when the Golden Rule was subordinated to the supposed pecuniary, if temporary, success of might and strength; when jealousy, discord and brutal antagonism prevailed; and all this to the ultimate loss of all who were engaged in the strife. Just as well do we remember when the unfortunate results of contest brought adversity and poverty. And with pleasure and satisfaction do we recall the awakening of our minds and hearts and souls, which exposed to our consciences the realization that acquaintances in our lines of business endeavor were in truth possessed of the same sensibilities as ourselves, and were willing to try the experiment of treating our competitors as friends and companions.

"How well we know, by experience, that it pays in dollars and cents to be decent, kind, frank and friendly towards each other. How clearly we understand, that except for the spirit of co-operation which has resulted from honest, fair and high-minded attitudes, many of us, to say the least, would have improverished the owners of our properties and business. Your president does not hesitate to say, with the firm belief that he is accurate and truthful, that he has never, since this institute was organized, entertained a doubt that, from every viewpoint, it would benefit everyone of us to conduct our business on the basis of the Golden Rule."

The speaker made reference to the frequently heard rumors of an impending industrial war between American and foreign steel makers. He said: "We have heard recently of considerable discussion relating to anticipated competition between the iron and steel manufacturers of the United States and their foreign competitors; but it is believed that should it become necessary an international conference would be held between all these interests, and a full, open discussion indulged in, after which a fair understanding could be reached. Of course, no agreement between the different interests relating to prices could legally be entered into without the sanction of our law administrators. But if the necessity arose, it is thought the approval of the public authorities of this country, if they were fully informed and permitted to express opinions on the subject, might be obtained.

"Conferences, open discussions and reasonable bases for maintaining peace and prosperity in business matters have become popular and desirable all over the world. It is not too optimistic to assert that a platform of peace and prosperity could and will be adopted, and if so would be adhered to by all parties concerned."

Faith in the Future

Judge Gary made this very interesting analysis of present business conditions:

"On the basis of the volume of business now being secured by the United States Steel Corporation, the industry as a whole at the present time is entering new orders for approximately 80 per cent of its normal capacity. This, when all things are considered, should be viewed as quite satisfactory.

"There appear to be no clouds on the business horizon which indicate the demand for steel products in the aggregate will be substantially reduced in the near future.

"While the earnings results for the quarter ending Sept. 30 have not yet been fully made up, we believe they will for the industry as a whole be fully as good as they were for the preceding quarter, which were quite satisfactory.

"Money is plentiful, and ample to care for all business. Collections are satisfactory, indicating the soundness of the credit situation. There is sufficient labor to meet all demands and, we think, should be and is entirely satisfied both with rates of pay and conditions of employment.

"We sometimes think unfavorable statements published concerning the trend of business are either pure surmises or put out for ulterior purposes, political or otherwise. One thing we know positively, namely, that the administration at Washington is reasonable and fair towards all business and all interests.

"So far as the question of import tariffs is concerned, we believe no legislation will be attempted, and certainly none passed, which will be really harmful to the business of the country.

"On the whole there appears to be plenty of business in hand and prospective, and sufficient funds and credit to do it with, to maintain the very favorable volume of production at reasonable profit which has prevailed for the past year. Therefore, we have faith in the future."

Materiel Division for Air Corps at Dayton

The War Department has approved the establishment at McCook Feld, Dayton, Ohio, of the Air Corps Materiel Division, under the command of Brigadier General William E. Gillmore.

General Gilmore, who has, since the World War, been Chief of the Supply Division in the office of the Chief of Air Corps, Washington, will establish his headquarters temporarily at McCook Field and upon completion of facilities at Wright Field, near Dayton, will move to that station.

The new Materiel Division will consolidate under one head all the activities now carried on by the Engineering, the Supply and the Industrial Planning Divisions of the Air Corps, located at the Air Corps Experimental and Engineering Laboratories and within a few miles of the aviation supply depot at Fairfield. The chief of the division will be able to exercise close supervision over these and there will be immediately available to him expert technical advice on all phases of his work.

For Greater Efficiency

While the details of administration are not yet complete, the functions of the Materiel Division will include experimental engineering, procurement of equipment, maintenance of equipment, and industrial planning.

This reorganization will result in greater efficiency within the Air Corps and a considerable saving in expenditures. It will also relieve the Chief of Air Corps of a great amount of detail work and thereby enable him to concentrate on the military activities of the corps. However, he will continue to exercise general supervision over the Materiel Division through a small section in his Washington office.

Weak Financial State of Auto Industry Affects Machinery Trade in Britain

Hope in increased demand for small, low-powered car

By Our London Correspondent

The machine tool trade in Great Britain can best be described as marking time. Most branches of the engineering industry have for a considerable period made few demands, the only important exceptions being the motor industry and railway shops, both home and overseas. This is an old story. Of late British railways have sent out but few inquiries, at least to machine tool firms, and, owing to the season of the year, and perhaps more particularly to current events, the automobile industry, outside a few firms, has also been a rather poor customer. As a whole the automobile industry of late appears to be in a hesitating state of mind. Orders from that source have probably not been as numerous as during the corresponding period last year, but such business as the machine tool industry has received lately has come mainly from this particular quarter.

Uncertain Finances

Thus, all the eggs have seemed to be in one basket and the fact has caused a little perturbation. For the finance of some sections of the motor car industry has long been regarded as doubtful. That the distrust still has a foundation is shown by one or two failures of late and also the predicament in which even well established firms find themselves. On the financial side, and possibly even on the manufacturing side, re-organization will be needed. In one or two instances this fact has necessarily been made broadcast, the firms concerned being public companies. Such disclosures cannot, however, be helpful to trading; few people will be willing to purchase a car the makers of which may possibly be going out of existence directly after delivery. This may be unlikely but in one or two instances is not altogether impossible.

Sections of the motor trade seem to have been endeavoring to finance themselves at the expense of the machine tool industry. Motor firms—and not only motor firms—have acquired new plants on the hire-purchase system, or equivalent, for a number of years, but recent proposals of one such firm, quite well-known, carry the risk rather further. Orders have been offered of late with the understanding that no payment shall be made until some months after delivery, and then that payment shall be made at stated intervals, and shall depend on the business position of the motor car firm itself.

The immediate future of the motor industry is partly tied up with the results of the Olympia motor show. It is often estimated by the value of agents' orders. These are more in the nature of estimates. It seems certain that a feature of the motor trade in the coming season will be the increase of relatively small six-cylinder cars and of all-steel bodies and, to turn to detail, cellulose finishes. More than one model of the £100 car has also been introduced.

Figures just available on motor taxation give an idea of the present market in Great Britain. During the nine months ending with August last, the total receipts in connection with licenses amounted to £17,579,437, a sum from which some deductions on account of the use of pre-war engines, etc., have been made. Current licenses in connection with motor vehicles as usually known numbered about 1,690,000, including 676,000 cars, 630,000 motorcycles, and 248,000 commercial vehicles. Exports of motorcycles and also of ordinary cycles have, despite discouraging circumstances, definitely increased in numbers so far this year, though prices obtained have shown a decline.

Reference has been made to the decline in railway work available. This has led to the temporary closure of an old-established locomotive firm employing lately about 400 workpeople. The closure is not intended to be permanent; it has been frankly described as "marking time" for the present.

Transportation Meeting of S.A.E. at Boston

The preliminary program for the transportation meeting of the Society of Automotive Engineers has just been announced. J. F. Winchester, chairman of the general committee in charge of this meeting, has prepared a most interesting series of sessions which will include special attention to subjects of particular interest to transportation executives at this time. The meeting will be held on three days—Nov. 16, 17 and 18 at the Copley-Plaza Hotel, Boston.

A brief resume of the subjects to be covered, with the speakers, is given here: "The Motor Truck's Place in Transportation" will have its own session, which will be conducted by F. I. Hardy, assistant to the chairman of the executive committee of the Boston & Maine R.R. William P. Kellett, consulting engineer, will discuss container systems at this meeting.

"Trucking at Railroad Freight Terminals," is the title of a paper that will be presented by Bruce V. Crandall, president of the *Railway Review*. The New Haven R.R.'s highway operation system will be explained in many of its phases by A. P. Russell, president of the New England Transportation Co. "Economics of Motor-Vehicle Transportation Correlated with Steam and Electric Railroads" will be presented by G. L. Wilson, of the Wharton School of Finance and Commerce, University of Pennsylvania.

The session on maintenance will take up several topics, including "Maintenance of tools and Fixtures" by A. H. Leipert, district service manager for the International Motor Co. Another paper by a prominent engineer will take up fleet maintenance operation.

"Merchandising Motor Truck Transportation" is the topic to be discussed by C. S. Lyon, vice-president and general manager of the Motor Haulage Shop and Garage Corporation. G. T. Seely, vice-president of the Chicago Motor Coach Co., will reveal some valuable information conerning modern motor coach operation.

A special session on tires will hear James A. Buchanan, of the Bureau of Public Roads, in an address "The Motor Truck and Its Relations to the Vehicle and the Road." Other problems of tire wear and maintenance will be taken up.

The Transportation Banquet will be held on Wednesday evening and the principal address will be delivered by Professor W. J. Cunningham, of the Graduate School of Business Administration, Harvard University. His subject will be "Railroads and Highways: Economics of Co-ordination."

New York Section Meeting of Welding Society

A paper on the Stelliting of metal parts was read by A. V. Harris of Haynes Stellite Co. at a meeting of the New York Section of the American Welding Society, held at the Engineering Societies Building, Oct. 19, 1926. A brief resumé was given of what has been accomplished by applying stellite to surfaces subject to abrasive wear and heat, such as dies and all kinds of cutting tools. This alloy of chromium, cobalt, tungsten has the property of being hard and of retaining its resistance to abrasion even at red heat. An actual demonstration was given to show the right and the wrong ways of handling the metal. An oxy-acetylene flame was used with Stellite in the form of a rod, and surfaces and corners were built up on various kinds of steel.

Standardization of Drafting Practice Is Planned

An organization meeting of the American Society of Mechanical Engineers' Sectional Committee on Standards for Drawings and Drafting Room Practices was recently held at the Engineering Societies Building in New York City. Twenty-five were present at this meeting and a substantial beginning was made in the work of initiating efforts along this line of standardization.

Prof. Franklin De R. Furman, head of the department of machine design, at Stevens Institute of Technology, was appointed temporary chairman, and Carl W. Keuffel, supervisor of the optical department of the Keuffel & Esser Co., was appointed temporary secretary of the new committee.

Tariff On Pig Iron

An elaborate study of the pig iron situation has been completed by the staff of the U. S. Tariff Commission. All of the documents are now in the hands of the members of the commission. The investigation is being made to determine whether or not the commission should recommend an increase in the pig iron duty.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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BECAUSE it has brought the tariff question squarely to the front as a politico-economic issue in the United States, the manifesto urging that the customs barriers which obstruct trade everywhere should be abolished has attracted wide attention in this country. It was given out in London. The cables suggest that Montagu Norman, governor of the Bank of England, inspired it. It is signed by many European bankers, publicists and economists, but the stir it has created in this country was chiefly due to the fact that J. P. Morgan, Albert H. Wiggin, John J. Mitchill and Gates McGarrah were also among the signatories.

The administration at Washington has been quick to announce that the philosophy of free trade, by which the manifesto is informed, is not accepted by our present Government, but those who favor a reduction of the American tariff have been much encouraged by the pellucid logic of the European appeal, and the high protectionists are already predicting that poverty will follow if the present duties are reduced.

But as there is no reason to expect that the Fordney-McCumber bill will be repealed while Mr. Coolidge is President no cause for immediate apprehension exists, and the excitement that the manifesto has created is significant only because it shows that business men are becoming hypersensitive to news that can be unfavorably construed.

This hypersensitiveness is also indicated by the reaction against installment buying that is now becoming apparent. Henry Ford calls it the "dangerous debt industry." A. M. Dodd, of Fort Wayne, Ind., made a speech before the annual convention of the National Hardware Association in which he described it as "a devastating disease that would only be cured by a buyers strike," and George F. Johnson of the Endicott-Johnson Co., criticized it as "undermining the national spirit of thrift." That talk of this kind may make it difficult to finance installment obligations is obvious and some merchants predict that the result will be a reduction in installment sales.

A revival of the weakness in cotton as the shadow of the next government report becomes visible is the only other development of the week that can be pessimistically construed. The idea that the cotton market can be held up by talking of "holding" is being abandoned and the necessity for definite and affirmative action becomes clearer day by day. For this reason it is certain that Congress will be asked to "do something for cotton" just as soon as it convenes on Dec. 6. But that date is nearly six weeks off and before it arrives the mills may have a chance to buy some very cheap cotton. They should take advantage of it for the crop is passing into the hands of manufacturers everywhere.

What's Doing in Industry

October closes with a total volume of business that is probably disapppointing to many manufacturers and dealers in the machinery and machine tool industry. Actual sales figures are not yet available, but it is believed by many that the sales volume fell off slightly. Inquiries received during the early part of the month had led dealers to expect more orders than were actually received.

However, there is a general trend toward better conditions all through the industry. Most factories are busy and in many cases orders on hand guarantee steady production for the rest of the year. The Mid-West is the most active section of the country. Automobile and accessory manufacturers in Detroit are buying sparingly right now, but some expansions are said to be under way. Chicago reports a sluggish market, with automotive and farm implement manufacturers furnishing some current business. Increased demand for various types of machinery is reported from Cincinnati, this business coming from a widely scattered territory. New orders make a satisfactory volume in Milwaukee, special equipment leading in this demand. The market has steadied in Cleveland and prospects for the remainder of the year are good.

In the East business is spotty. New York reports no appreciable change; orders are slow and inquiries are about normal. Manufacturers of high-production machinery in New England are getting orders for this class of equipment. The fall season is not up to expectations in Buffalo, but October was a better month than September. Bearings and transmission machinery are moving in fair volume in the Philadelphia district.

The other commodities have not changed much. Sugar has advanced because the storm in Cuba brought the strength of the statistical position into relief. The decline in coffee was arrested by the arrival of an overdue reaction, but the trade continues to buy from hand to mouth and confidence in present prices is lacking.

Corn has been almost weak and wheat somewhat feeble. There is nothing to encourage speculation in either. Rubber has shown less resiliency because the talk of a reduction in the automobile output persists. For the same reason there is less activity in the steel industry. Scrap iron is lower and copper is also weaker at 14¼ cents.

A continued reduction in the new building planned is also indicated, and in constructive activity the winter promises to be comparatively quiet. Distributive trade is holding up fairly well, but the business in cotton goods has been halted by the renewed weakness of cotton futures. Silk is lower, and wool and woolen goods show but little change. A slight increase in new orders for lumber is noted, but fewer bricks are being sold in the metropolitan district.

Until late in the week this relaxation seemed to be reflected in the stock market. The tone was distinctly easier, if not weak, and specialties as well as the old "stand-bys" like U. S. Steel showed important declines. But there was a substantial recovery on Thursday and the tone improved as traders convinced themselves that there would be no reduction in the Federal Reserve rate until after the election. While the implication that politics is considered in fixing the rate is unwarranted it has made traders more confident, nevertheless, and but little change in the price level is now expected until after the second of November, when the course of the market will be shaped by the election returns.

The growing scarcity of ocean tonnage is becoming a very important feature of the situation. It is due to the English coal strike. Germany has put an embargo upon further exports of coal and as a result Scandinavia and South America are now compelled to get their fuel in the United States. Coal is in consequence higher, so are freights, and the importers of sugar as well as the exporters of grain, are at a great disadvantage. These conditions will probably continue throughout the winter as a formal settlement of the British coal strike seems unlikely and the miners are informally returning to work but slowly.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

Manufacturers of automatic and production machinery in the New England territory report that favorable business conditions continue, although there is a slight falling off in the volume of inquiry mail. Business in lines allied with the automotive industry has suddenly become slightly depressed, but the condition is regarded as temporary and to meet the situation a slowing up of production has been ordered.

As a result a reduction in working hours is made effective this week in one important company producing almost exclusively for the automotive trade.

That the situation is regarded as temporary is seen the fact that the reduction of hours was adopted rather than to release employees.

In another center there is a slight lull. However, the number of employees at the present time is about 5 per cent over a year ago.

Buffalo

Reports from machine tool dealers in the Buffalo district indicate that the autumn business is not as good as was anticipated earlier in the year. It looks as though the fourth quarter of the year would not be up to the first and second quarters in the volume of business done.

Business got away to a poor start in Buffalo after the close of the vacation season and some believe that the proximity of election is causing some manufacturers to put off buying.

October will be somewhat better than September but September was by no means good. The demand for electrical equipment has fallen off somewhat from the rate of demand earlier in the year. The demand for contractors' equipment is at a standstill but this is considered a purely seasonal condition. Contractors planning winter operations are quite well supplied, or their orders have been placed. The demand for snow removal equipment has not yet become noticeable, but this demand is expected to be good later.

While it is rather curious that the electrical equipment end of the business was at the high point of interest during the earlier part of the year, there are indications now that the general machine tool trade is going to supersede it for the last quarter.

Milwaukee

While the experience of manufacturers of metal-working equipment in this market in recent weeks has been a lessening of pressure for quick deliveries, the number of new orders for tools is considered quite satisfactory. New business embraces many orders for special equipment which requires several weeks or months to put through the works, in contrast with the relatively brisk demand for standard tools on which shipments can be made more or less promptly. Automobile manufacturers looking ahead to the time when production will require speeding up to meet the spring demand, especially for passenger cars, are placing orders now for tooling needs of a more or less specialized nature.

The call for tools is gradually simmering down to a single item character. While there are a number of projects of unusual size under way in various parts of the state, the effort of manufacturers in the foundry and machine shop field appears to be toward making the most of existing plant area. Locally, one of the largest projects is that of the Chain Belt Co., which is working on the third major unit of its Milwaukee works, which eventually will replace the original plant in the heart of the city manufacturing district. The present construction calls for a new building for the manufacture of contract engineering, such as conveyors, elevators, traveling water screens, bunkers, hoppers and general steel structural work. Eight traveling cranes, in addition to floor and toolroom equipment, will be installed.

General industrial conditions in the Milwaukee district are described by authorities as steady, with the volume of business and employment showing a seasonal increase. Employment increased moderately in the past 30 days, and foundries and machine shops have standing orders for all of the suitable skilled labor that applies to employment offices.

New York

There is no appreciable change in business in this market over the condition of the past two weeks. Orders are coming in slowly and inquiries are keeping pace with normal demand. The nature of present business continues to indicate that only replacements are being ordered now, but there are a few scattered cases of expansions or new enterprises.

Several dealers in this market are working on the list recently issued by a contractor for the New York Edison Co. The urgency of this request gives the impression that the tools, about twenty in all, will be purchased very soon. The Seaboard Air Line R.R. has issued a preliminary list for a fairly large list of shop equipment. The New York Central and the General Electric continue to be consistent buyers, each having placed orders in the past week.

The used tool market has picked up a little, buyers being tempted by attractive price offerings on some very good equipment.

Orders placed in the past week call for standard types of lathes, grinders, vertical shapers, automatic lathes, hand milling machines and jig borers. Some large equipment was also bought in the form of steam hammers and a gear generator.

Philadelphia

Machinery and machine tool dealers in Philadelphia reported a quiet period this week, with a light falling off in inquiries and a lack of outstandng orders. Purchases of bearings by automobile concerns was the feature of the week. Plants producing this equipment are operating at full capacity, aided by orders from foreign purchasers in the market.

Eastern industries have been purchasers of roller bearings. Producers of transmission belting equipment found a reasonably good market during the last week, particularly in the replacement line, although there has been some orders for plant extensions.

Eastern railroads have bought locomotive engine repair equipment. Plants continue to operate up to 70 per cent of capacity, on the average.

Cleveland

Consistent buying of machinery and machine tools for the past two weeks has featured the Cleveland market. Present indications, based on the steadiness of the market for the past two months, and the new inquiries on hand, point to a successful termination of the year. Orders reaching the local market are not confined to any certain industry, but are general in scope and diversity. Recent buyers included steel, oil, rubber tire, electrical, pipe threading, automotive, refrigerators and farm implement manufacturers.

Production is nearing capacity, with a noticeable shortage of skilled machinists. The American Plan Association reports a 30 per cent increase in the demand for machine tool workers. This increase follows a steadily growing demand all during the summer months.

Chicago

No perceptible change in the machine tool market has been noted within the last few days. Reports by dealers indicate a somewhat sluggish situation, with no immediate prospect of improvement. Such lists as have been issued appear to be no nearer closing, so far as can be learned. A number of prospective sales have been held up until later in the year, and present trade is largely limited to hand to mouth buying. Railroad business is negligible.

Automobile and motor truck manufacturers are the principal factors in the market at this time, production in their lines having been speeded up to a point that necessitates additional shop equipment. Among these, the Nash Motors Co. is one of the principal buyers. The International Harvester Co. is doing some buying for its factory at Fort Wayne, its purchases consisting chiefly of single tools or small lots.

With two or three exceptions, dealers in used machinery report an inactive market. Up to the present, business for October compares rather unfavorably with that of September, but those optimistically inclined believe the lull to be only temporary, and look forward to increased production in general industry to create a better market at an early date.

Cincinnati

The demand for machine tools showed some increase in the past week, according to reports of Cincinnati manufacturers and selling agents. None state that they did less business than in the previous week and the great majority state that they did more.

Orders booked in the week came from all sections of the country and the purchases made were well diversified as to sizes and types of tools. The greater part of the week's sales was made up of single tools and replacements.

A few manufacturers report a slight falling off in the demand for tools from the South, but this is not regarded as a matter of great importance, as it has been more than offset by the increased demand from other sections.

There is expressed a general confidence that the demand for machine tools will be good for some time to come, with an increase rather than a falling off of sales. Inquiries came in freely through the week, from all sections of the country. The greater part of these were in regard to single tools and replacements, but there were some lists.

Detroit

Machinery and machine tool dealers in Detroit are satisfied with the present market conditions. Sales are numerous with automobile factories and accessory plants being the principal buyers. Only the fact that everyone seems to be buying in some quantities keeps the market from falling back slightly just this time, but leading dealers feel that the next few weeks will find several lists closing.

Fall business so far has been good with prospects that the automotive centers of Michigan will continue at full production schedule. Many minor replacements of tools have been noted in the Oldsmobile and Reo plants, at Lansing, and in the Buick plant at Flint. Chevrolet is buying new machinery in considerable quantities, while at the Oakland plant additions are moving forward rapidly.

None of the Detroit plants have placed any large orders during the past week but scattered sales are reported for Hudson, Paige and Dodge. These have consisted chiefly of small tools and single machines.

Italy to Promote Domestic Manufacture of Tractors

In its effort to curtail imports as much as possible the Italian government has turned its attention to the greatly increased quantities of foreign agricultural machinery brought into Italy during the past few years. During the first four months of this year total imports of this type of machinery amounted to 11,294 metric tons which was just about double the quantity imported during the corresponding period of 1925.

Direct restriction of imports is apparently not under consideration, as this policy would be inconsistent with the government efforts to increase wheat production and promote the use of improved methods. Rather, it is hoped that the development of the Italian industry can be stimulated. It is believed the government's efforts will be directed chiefly toward tractors. If its tentative plans are developed practically, attention will be paid to the design and building of tractors that consume as little fuel as possible. Success in that direction would mean a reduction in the Italian imports of petroleum, which is one of the problems with which the government is concerned.

Althoff Leaves Service of Commerce Department

The resignation of William Althoff, assistant chief of the industrial machinery division, Department of Commerce, was anounced last week. Mr. Althoff is leaving the department to accept a position in the export organization of the Studebaker Corporation, of which he is to be a special representative for Mexico and Cuba, supervising the factory's dealer agents in that region.

Before entering the employ of the Department of Commerce Mr. Althoff resided for ten years in Latin America, where he was engaged in the sale of automobiles, machinery and like products. During his period of service in the Department of Commerce Mr. Althoff has been engaged in the promotion of the sale of American industrial machinery in foreign countries.

End Conferences on Air Regulations

The third conference by the aeronautics branch of the Department of Commerce for the purpose of affording manufacturers of airplanes an opportunity to criticize and discuss the proposed draft of air regulations prepared by the department was held in Washington on Oct. 8. This is the second conference to which airplane manufacturers have been invited.

Seven conferences for the purpose as outlined were held by the aeronautics branch, under the supervision of Wm. P. MacCracken, Assistant Secretary of Commerce for Aeronautics. The second conference was held on October 6, and was attended by producers of aircraft engines and others interested in the promotion and development of civil aviation in this country. The fourth conference was held on Oct. 11 and was attended largely by air mail contractors and air-way operators; the fifth, on Oct. 13, was attended by representatives of air service companies operating sight seeing services and conducting special flights; the sixth, on Oct. 18, by insurance interests and the last, on Oct. 22, by publishers.

Galvanizing Standards to Be Developed to Improve Zinc Coatings

The organization of a committee to carry on the work of standardizing the quality of zinc coatings for iron and steel products has been completed by the American Society for Testing Materials, under the auspices of the American Engineering Standards Committee. The following six technical subcommittees are ready to begin their work:

Hardware and Fastenings, R. F. Hosford, chairman, American Telephone and Telegraph Co.

Sheets and Sheet Products, J. T. Hay, chairman, United Alloy Steel Corporation.

Plates, Bars, Structural Shapes and their Products, V. F. Hammel, chairman, Electric Bond and Share Co.

Pipes, Conduits and their Fittings, F. N. Speller, chairman, National Tube Co.

Wire and Wire Products, J. C. Johnson, chairman, Pennsylvania Railroad System.

Methods of Testing, C. D. Hocker, chairman, Bell Telephone Laboratories.

Ten Million Increase in Implement Exports

Exports of American agricultural implements and farm equipment during the first eight months of 1926 were valued at $64,247,000, an increase of approximately $10,000,000 over the corresponding period of 1925, according to a statement issued by the agricultural implements division of the Department of Commerce.

The items showing the largest gains were harvesters and binders, wheel tractors, and combined harvesters and threshers. Total imports of agricultural implements during the first eight months of this year were valued at $3,849,000 compared with $2,249,000 for the corresponding eight months' period of 1925.

Lighter-than-Air Base to Go to San Diego

Edward P. Warner, assistant secretary of the navy for aviation, and Rear-Admiral William Moffett, chief of the Bureau of Aeronautics, at a luncheon given in their honor and in subsequent interviews at San Diego, recently announced that San Diego is to get the proposed West Coast lighter-than-air base when Congress appropriates funds for carrying out the project. The sum of $20,000,000 has been estimated as necessary for the base.

New Engineering Laboratory for Princeton Courses

One of the objectives for which funds are being sought by the committee directing the Princeton Fund is an engineering laboratory to house the School of Engineering at Princeton University. Present facilities are quite inadequate.

The appeal is based on the fact that the engineering course at Princeton differs materially from the courses offered at other universities and technical schools. In fact, the trustees of the university only granted the request of the engineering alumni for the revision of the old courses that resulted in the present plan, on the distinct understanding that Princeton did not intend to compete in engineering with the well established colleges. It was not their desire to add another standard engineering school to this list but they felt that if the fundamentals of the various branches of engineering could be included with cultural subjects they would be willing to establish the other courses. This attitude was based partly on expressions, by prominent practicing engineers and educators, of the opinion that more cultural studies should be given a place in the engineering curricula.

Sea-Going Air Bus Built by Dornier

What is claimed by its makers to be the largest hydroplane in the world will soon be launched from the Dornier Works at Friedrichshafen, Wurtemberg, according to a report to the Department of Commerce. Accommodation is provided for twenty-one passengers and a crew of four persons—two pilots, a mechanic and a wireless operator.

The new machine is intended for sea traffic. The new plane is much larger than the well-known Dornier-Wal plane; its weight on rising is 10 tons, approximately 50 per cent more than the Wal. With its two Rolls Royce Conder motors, each of 650 hp., it will attain almost the same speed as the Wal, which has air-cooled jupiter motors.

The body of the plane has a length of 77.1 ft. and a width of 11.4 ft.; if the side pontoons are included the width is 24.6 ft. Directly behind the bow there is a car to seat 13 passengers. Behind this, and accessible through a small gangway, is the pilot's room and on the starboard under the entrance is a lavatory. The tank room which can hold enough oil for a journey of 1,650 miles lies directly behind the wings, over which the two motors are erected. The luggage room is situated behind this and then still another cabin with accommodation for eight passengers. The wing span is 28.5 meters.

The hollow body of the plane is not used but it can be entered by manholes when necessary. The pontoons are divided up into several watertight compartments by bulkheads, so that in case of leakage in one compartment, only a small part of the floating capacity of the ship is lost.

Dr. Humphreys Resigns from Stevens

DR. ALEXANDER C. HUMPHREYS, for almost twenty-five years president of the Stevens Institute of Technology, at Hoboken, resigned on Oct. 21 at a special meeting of the trustees in the Metropolitan Club. He had intended to leave at once, but the board got him to remain until June 5. He is seventy-five years old.

Anson W. Burchard, vice-chairman of the board of the General Electric Company and chairman of the finance committee of the Stevens trustees, presided at the special meeting. Later he said that the board would amend the bylaws to change the title of the presiding officer of the board from president to chairman, and that Dr. Humphreys had agreed to become chairman when he resigned as president.

In recognition of Dr. Humphreys's long service the trustees voted him a retiring allowance to supplement that which he will get from the Carnegie Foundation. After the meeting Mr. Burchard gave a dinner as an impromptu testimonial to Dr. Humphreys. The board also adopted resolutions in recognition of his services to Stevens and the engineering profession.

Business Items

The Geometric Tool Co., of New Haven, Conn., announces the appointment of R. S. Stokvis & Fils, of 20 Rue des Petits Hotels, Paris, France, as exclusive agents in France for its products.

The branch office of the American Hammered Piston Ring Co., of Towson, Md., has moved into larger quarters at 677 Folsom St., San Francisco, Calif. T. L. Ford is zone manager in charge of this office.

Lee & Clark, of 549 Washington Blvd., Chicago, have been appointed sales representatives in that territory for the Pennsylvania Pump and Compressor Co., of Easton, Pa.

Under an arrangement with the Illinois Steel Co., S. P. Tinney, a metallurgist on the staff of the Bureau of Mines, will make further studies of blast furnace conditions. These investigations, which will be conducted at South Chicago, have as their objective a more definite knowledge of what transpires in the blast furnace.

The Thomas & Skinner Steel Products Co., of Indianapolis, has purchased the property owned and operated by the Pioneer Brass Works at Twenty-third St., in Indianapolis.

As soon as certain necessary alterations are made the Thomas & Skinner factory and offices will be moved into the new location.

The Botfield Refractories Co., of Philadelphia, manufacturer of "Adamant" fire brick and cement, announces the appointment of the following sales representatives: The Westwater Supply Co., Columbus, Ohio; the Klinger-Dills Co., Dayton, Ohio; the Coan Equipment Co., Fort Wayne, Ind.; and the Cleveland Tool and Supply Co., Cleveland, Ohio.

The Fairmont Manufacturing Co., of Fairmont, W. Va., announces the establishment of a modern aluminum rolling mill to manufacture all kinds of sheet and plate products. Offices have been opened in New York City at 52 Vanderbilt Ave., in charge of L. M. Brile. Officers of the company are: W. J. Adam, president; L. M. Brile, vice-president and sales manager; F. M. Brown, secretary and treasurer. C. J. Wolfe is works manager.

Obituaries

HOWARD L. FRANKLIN, president of the Franklin Die Casting Corporation, of Syracuse, N. Y., died suddenly on Oct. 16.

EDWARD K. HILL, well-known mechanical engineer, and president of the Wheelock Engine Co., died in Berkeley, Calif., on Oct. 13. He had retired from active participation in business but had retained certain connections in more than one important engineering organization.

Personals

WILLIAM P. WOODSIDE has been appointed president of the American Twist Drill and Tool Co., of Detroit.

J. R. PARKER, formerly machine designer for the National Acme Co., has become designer for the Cone Automatic Machine Co., of Windsor, Vt.

GILBERT H. UNRUH, Baltimore representative of the Link-Belt Co., of Chicago, has opened offices at 618 Regester Ave., Stonleigh, Baltimore.

E. N. BRISHEIM, formerly of the Bock Bearing Co., Toledo, Ohio, has been appointed assistant to the general manager of the Timken Roller Bearing Service and Sales Co., Canton, Ohio.

S. C. PARTRIDGE has been placed in charge of the Buffalo office, industrial division, of the Timken Roller Bearing Co. Mr. Partridge takes the place of Lee Warrender, who resigned to enter another field of work.

M. I. DORFAN has been appointed engineer of the dust collecting unit of the Pangborn Corporation, of Hagerstown, Md. Mr. Dorfan has a wide experience in this line, and was at one time associated with the Allis Chalmers Manufacturing Co.

EVAN J. PARKER has joined the engineering staff of the Northern Engineering Works, of Detroit. He was formerly connected with the Morgan Engineering Works, of Alliance, Ohio. Mr. Parker will have charge of the sales promotion department.

CHARLES EISLER, president and treasurer of the Eisler Engineering Co., Inc., of Newark, N. J., sailed for Europe on Oct. 16. Mr. Eisler will spend some time in Russia, and will then journey through Belgium, France, Germany, Italy, Holland, Hungary, Norway, Sweden, Spain and Switzerland.

J. R. BRANDT has joined the Cleveland office of the Bridgeport Brass Co., of Bridgeport, Conn. Mr. Brandt will handle sales of raw materials in the Pittsburgh territory and also in parts of Ohio. He was formerly associated with the U. S. Copper Products Co., Rome Wire and Henning Nickel Rolling Mills.

YALE D. HILLS has been appointed manager of the Seattle branch of the Timken Roller Bearing Service and Sales Co. Mr. Hills was formerly manager of the Portland branch. When this office was closed he came to the main office at Canton, Ohio, where he has been located until his present appointment. R. H. Cross, who held the position of Seattle manager prior to Mr. Hills, has been made assistant to G. C. McMullen, district manager of sales, industrial division. Mr. Cross will continue to maintain offices at Seattle.

Calendar of Local Meetings

National Association of Cost Accountants

Boston Chapter. Nov. 18, national officers night.

Buffalo Chapter. Nov. 18. Subject: "Credit via the Balance Sheet," and "Insurance—Cost and Distribution," by W. F. Chase and Frank Vockrodt.

Cleveland Chapter. Nov. 17. Subject: "Defects in the Monthly Profit and Loss Statement," by W. B. Castenholz.

Detroit Chapter. Nov. 18. Subject: "Financial Control Policies of the General Motors Corporation," by Albert Bradley.

Erie Chapter. Nov. 15. Subject, "Fixed Asset Depreciation and Cost."

Hartford Chapter. Nov. 16. Subject: "Departmental Co-operation Within the Organization," and visit to plant of the Colts Patent Fire Arms Manufacturing Co.

Hawaii Chapter. Nov. 23. Subject: "Problem of Business Forecasting," by Prof. G. R. Kinnear, University of Hawaii.

Kansas City Chapter. Nov. 15. Subject: "Budgeting."

Los Angeles Chapter. Nov. 16. Subject: "Mechanical Devices in Cost Accounting."

Milwaukee Chapter. Nov. 18. Subject: "Standard Costs," by E. A. Camman.

New York Chapter. Nov. 9. Subject: "Accounting Procedure for Standard Costs," by E. A. Camman.

Philadelphia Chapter. Nov. 19. Subject: "New Uses of Insurance," by Dr. S. S. Huebner.

Pittsburgh Chapter. Nov. 17. Subject: "Cost Accounting in Relation to Establishment of Rates and Selling Prices," by W. C. Wright.

Providence Chapter. Nov. 11. Subject: "Problems in Textile Costs," by C. W. Bennett.

Rochester Chapter. Nov. 17. Subject, "Payroll Analysis," by C. F. Brown.

St. Louis. Nov. 16. Subject to be announced later. Speaker—C. M. Doisseau.

San Francisco Chapter. Nov. 22. Subject: "Cost Accounting for Special Services as an Aid to Management."

Springfield Chapter. Nov. 17. Subject: "Development and Installation of Budget Systems," by H. N. Sweet.

Syracuse Chapter. Nov. 15. Subject: "Setting the Selling Price," by H. G. Crockett.

Twin Cities Chapter. Nov. 16. Subject: "The High Cost of Distribution."

Utica Chapter. Nov. 15. Subject: "Inventories," by C. M. Finney.

Worcester Chapter. Nov. 11. Subject: "Government Budgetary Control and Costs."

American Society of Mechanical Engineers

Tulsa. Oct. 29. Hotel Mayo, Tulsa, Okla., Subject: "Elimination of Waste in the Refining Industry."

Philadelphia. Nov. 23. Power Meeting, Speaker, N. E. Funk.

Forthcoming Meetings

Management Week. National observance, Oct. 25 to 30. General theme—"Progress in Waste Elimination." Organizations co-operating are the American Society of Mechanical Engineers, American Management Association, American Institute of Accountants, Society of Industrial Engineers and the Taylor Society.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Fifth event, Grand Central Palace, New York City, Dec. 6 to 11. I. E. Moultrop, chairman advisory committee, Edison Electric Illuminating Co., Boston, Mass.

National Founders Association. Thirtieth annual convention, Hotel Astor, New York, Nov. 17 and 18. J. M. Taylor, secretary, 29 South La Salle St., Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 6 to 9. Details later. Calvin Rice, secretary, 29 West 39th St., New York.

American Association for the Advancement of Science. Annual meeting, University of Pennsylvania, Philadelphia, Pa., Dec. 27 to Jan. 1. Sam Woodley, executive assistant, Smithsonian Institution, Washington, D. C.

Society of Automotive Engineers. Annual meeting, Detroit, Jan. 25 to Jan. 28. W. Delchamps, chairman, meetings and sections department, 29 West 39th St., New York

The Weekly Price Guide

Rise and Fall of the Market

HIGHER coke prices are reflected in an upward trend in pig iron, particularly on No. 2 fdry. at Birmingham and Pittsburgh and bessemer at the latter point; New York, Philadelphia and Chicago, however, report declines in iron quotations. Scrap is down 25 to 50c. per ton at New York and steel demand shows marked recessions in buying for automotive and structural uses and agricultural implement manufacturing. Steel sheets are up 10c. in Pittsburgh and Cleveland. Bars and shapes hold firmly to the $2 per 100 lb. level at Pittsburgh mills, in large tonnages, with $2.10 applying on single carload lots. Steel plates remain at $1.90 per 100 lb., f.o.b. mill, in practically any quantity.

(All prices as of Oct. 22)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	26.37
BIRMINGHAM	
No. 2 Foundry	20.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.17
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	24.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.76
Bessemer	20.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.40	3.50	3.25	3.89
No. 12	2.45	3.55	3.30	3.94
No. 14	2.50	3.60	3.35	3.99
No. 16	2.60	3.70	3.45	4.09
Black				
Nos. 18 to 20	2.90	3.75	3.60	4.15
No. 22	3.05	3.90	3.75	4.30
No. 24	3.10	3.95	3.80	4.35
No. 26	3.20	4.05	3.90	4.45
No. 28	3.35	4.20	4.05	4.60
Galvanized				
No. 10	3.25	4.10	3.95	4.40
Nos. 12 to 14	3.35	4.20	4.05	4.50
No. 16	3.45	4.30	4.15	4.60
No. 18	3.60	4.45	4.30	4.75
No. 20	3.75	4.60	4.45	4.90
No. 22	3.80	4.65	4.50	4.95
No. 24	3.95	4.80	4.65	5.10
No. 26	4.20	5.05	4.90	5.35
No. 28	4.45	5.30	5.15	5.60

WELDED STEEL PIPE—Warehouse discounts are as follows

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	258
6	1.92	6.625	6.065	28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

— Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches ⅛	¼	⅜	½	1	1½	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
065″	16	.19	.20	.21	.22	.23	.25	.27
083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 1/32, 8.35c.; 1/16, 7.85c.; 1/32 to 1/16, 7.35c. per lb. *Flat, 1/16@1/4-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15 37½
Tin, 5-ton lots, New York			70 87½
Lead (up to carlots) E. St. Louis	8.07½	New York	8 87½
Zinc (up to carlots) E. St. Louis	7.32½	New York	8.25

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot.	16.50	20.50	15.00
Copper sheets, base	22.50	22.75	23.00
Copper wire, base	19.50	19.75	20.00
Copper bars, base	22.12½	22.37½	22.50
Copper tubing, base	24.50	24.75	25.00
Brass sheets, base	18.87½	19.12½	19.37½
Brass tubing, base	23.75	24.00	23.75
Brass rods, base	16.62½	16.87½	17.12½
Brass wire, base	19.62½	19.62½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	13.05	12.01
Solder (½ and ½), (case lots)	43.62½	44.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			91 00
Commercial genuine, intermediate grade			63 00
Anti-friction metal, general service			32 50
No. 4 babbitt (f.o.b.)			14 50
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35 00 Electrolytic 39 00 Shot 36 00			

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.25 @12.50	11.50	11.25@11.75
Copper, heavy, and wire	11.50 @12.00	11.75	10.50@11.00
Copper, light, and bottoms	10 00 @10.37½	10.00	9.50@10.00
Heavy lead	6.75 @ 7.25	7.25	6.75@ 7.25
Tea lead	5.00 @ 5.25	5.25	5.75@ 6.25
Brass, heavy, yellow	7.00 @ 7.50	7.50	7.00@ 7.50
Brass, heavy, red	9.25 @ 9.75	9.75	9.00@ 9.50
Brass, light	5.87½@ 6.12½	6.50	6.25@ 6.75
No. 1 yellow rod turnings	8.00 @ 8.25	8.25	7.50@ 8.00
Zinc	4.50 @ 4.75	4.50	4.00@ 4.50

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9 50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15@0 20
Cotton waste, colored, per lb.	.10@ .14	.13½	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb	2.70†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.85½	.98	80
Lard cutting oil, 25% lard, per gal.	55	50	48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	35	35	29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1662½	.1712½	.1687½
Solder (½ and ½)	per lb.	.4362½	.4112½	.395
Cotton waste	per lb.	.13@.17½	13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.10	3.10	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.49
Cloth	3.10	3.50	3.75
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		4.50@ 5.00
Coke, prompt foundry, Connellsville	per net ton		5.25@ 6.00
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16 75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1¼x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1¼x¼-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{7}{16}$-in and smaller and 65% for ½-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2$\frac{7}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb for 1¼ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ⅜-in., $7.00* per 100 lb. at New York warehouses; ½-in., $6.00* per 100 lb

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Bishop—State Highway Comn., Forum Bldg., Sacramento—heating furnaces and tools for division shop here. Estimated cost $2,500.

Calif., Los Angeles—Bd. of Education, H. A. Campion—machine shop equipment $10,000, cabinet making, mill working, carpentry and pattern equipment, power saw $25,000, automobile electric equipment, etc. $48,000, for Wiggins Trade School.

Ind., Veedersburg—Globe Railway Equipment Co., Railway Exchange Bldg., St. Louis—foundry equipment and special machinery for the manufacture of car door hangers, spring track devices, etc. for proposed 1 and 2 story, 60 x 150 and 50 x 200 ft. plant.

Mass., Brighton (Boston P.O.)—H. M. Rittenberg, 12 Garden St., Boston—miscellaneous tools and equipment for extensive repair and service garage on Washington St. here.

Mass., Quincy (Boston P.O.)—Matheson Machine Shop, Water St.—additional machinery and equipment for proposed 40 x 100 ft. and 20 x 50 ft. machine shop.

Mo., Overland—Overland Sheet Metal Co. spotwelder.

Mo., St. Louis—F. W. Holstein, 3515A Alberta St.—woodturning lathe.

Mo., St. Louis—Security Fire Door Co., 3044 Lambdin Ave.—62 in. power gap sheer, 10 gage capacity 18 in. gap, also power metal cutting band saw.

O., Akron—Firestone Tire & Rubber Co., 1289 South Main St.—open side planer.

O., Cleveland—Pulaski Foundry & Mfg. Co., 2422 Euclid Ave.—18 ft. open side planer.

O., Columbus—Dept. of Public Works & Highways, Ohio-Hartman Bldg., H. C. Hineman, Purch. Agt.—heavy presses, air compressors and hoisting equipment for garages in various cities.

O., Columbus—Yardley Screen & Weatherstrip Co., 715 Gustarus Lane, B. W. Yardley, Purch. Agt.—woodworking machinery for proposed 1 story, 100 x 320 ft. factory later. Metal working machinery.

Pa., Pittsburgh—Bd. of Education, Fulton Bldg.—8 lathes, 3 grinders, 1 milling machine, 1 arbor press, 1 shaper, 1 power saw, 2 drill presses and 12 woodworking machines for Taylor Alderdice school, also 13 lathes, 1 arbor press, 1 power saw, 2 grinders, 1 milling machine, 2 drill presses and 1 shaper for Arsenal vocational school.

W. Va., Logan—Guyan Machine Shop.—punch and slitting shear for 2 in. plate.

Opportunities for Future Business

Calif., Los Angeles—American Laundry Machinery Co., 331 East 3rd St., awarded contract for the construction of a 3 story, 90 x 90 ft. factory at Fourth and Anderson Sts. Estimated cost $53,400.

Calif., San Francisco—Veyhle & Collins and Herring Mill Dean Reversible Window Co., Brannan and 5th Sts., plan to rebuild planing mill and cabinet shops recently destroyed by fire. Loss is estimated at $200,000.

Conn., New Haven—C. W. Mettler, 132 Lawrence St., awarded contract for the construction of a 1 story, 25 x 100 ft. machine shop. Estimated cost $15,000.

Conn., Wallingford—W. A. Ives Mfg. Co., C. J. Benham, Pres., Cherry St., manufacturers of bits and augurs, had plans prepared for the construction of a 1 story, 65 x 242 ft. factory. Estimated cost $75,000. Private plans.

Ind., Bloomington—H. P. Electric Co., had plans prepared for the construction of a factory. Estimated cost $40,000. Private plans.

Ind., Gary—Walter Bates Steel Corp., East 5th Ave., will build addition to plant. Estimated cost $100,000. Private plans.

La., Homer—Louisiana & Northwestern R.R. Co., 220 Broadway, New York, N. Y., will build a 54 x 88 ft. machine shop, 28 x 88 ft. coach shed, etc., to replace fire loss here. Estimated cost $10,000.

Kan., Newton—Atchinson, Topeka & Santa Fe Ray. Co., 80 East Jackson Blvd., Chicago, Ill., awarded contract for the construction of a 1 story, 80 x 100 ft. addition to rail mill and frog shop here. Estimated cost $50,000. Noted May 27.

Me., South Portland—Standard Oil Co., Park Sq. Bldg., Boston, Mass., awarded contract for the construction of a 1 story addition to garage and repair shop on Main St., here. Estimated cost $40,000.

Mass., Brookline (Boston P.O.)—David Miller, 43 Brookline Ave., is having plans prepared for the construction of a 1 story welding shop. Estimated cost $40,000. A. F. Halfenstine, 143 Washington St., Archt.

Mass., Framingham—West Boston Gas Co., 49 Howard St., is having preliminary plans prepared for the construction of a 1 and 2 story garage and repair shop. Estimated cost $50,000. C. M. Baker, 25 Arch St., Boston, Archt.

Mass., Indian Orchard—Chapman Valve Co., Pine St., Springfield, awarded contract for the construction of a 1 story, 100 x 450 ft. machine shop. Estimated cost $500,000.

Mass., Quincy (Boston P. O.)—H. T. Dennison, 415 Quincy Shore Drive, will build a 1 story, 65 x 100 ft. repair and service garage. Estimated cost $45,000. Private plans.

Mass., Watertown (Boston P.O.)—Arden Box Toe Co., 36 Pleanant St., awarded contract for the construction of two 1 story, 50 x 100 ft. factory buildings on Arlington St. Noted Oct. 21.

Mich., Muskegon—March Irrigation Co., Western Ave., manufacturers of irrigation supplies, will soon award contract for the construction of a 2 story, 45 x 66 ft. office and 1 story, 66 x 200 ft. factory on Bank St. Estimated cost $40,000. Vander West & Child, Montgomery Blk., Archts and Engrs.

N. J., Hoboken—Cooper-Hewitt Electric Co., 95 River St., will soon receive bids for the construction of a 4 story, 80 x 200 ft. addition to plant. Estimated cost $100,000. Lockwood, Greene & Co., 1 Pershing Sq., New York, N. Y., Archts. and Engrs.

N. J., Jersey City—Hudson County Buick Co., 870 Bergen Ave., had plans prepared for the construction of a 2 story addition to plant. Estimated cost $100,000. J. T. Rowland, 100 Sip Ave., Archt.

N. Y., Brooklyn—Sinclair Oil Refinery Co., 45 Nassau St., plans the construction of a repair and service garage on Grand Ave. Estimated cost $475,000.

N. Y., New York—Consolidated Gas & Electric Co., 130 East 15th St., plans the construction of a 6 story storage and shop building at 120 Amsterdam Ave. Estimated cost $200,000.

N. Y., New York—Packard Motor Car Co., Broadway and 61st St., plans the construction of a 200 x 225 ft. repair and service garage at 11th Ave. and 44th St. Estimated cost $75,000.

N. Y., Oneonta—The Delaware & Hudson Co., J. T. Loree, Gen. Mgr., 32 Nassau St., New York, awarded contract for the construction of a 2 story, 130 x 230 ft. machine shop here. Estimated cost $200,000.

O., Canton—Teigler Tire & Supply Co., 9th St. and Cleveland Ave. N. W., has work under way on the construction of an 81 x 130 ft. sales and service station. Estimated cost $125,000 to $150,000.

O., Cincinnati—Royal Blue Bed Springs Co., Dempsey St., awarded contract for the construction of a 2 story, 275 x 360 ft., factory on Beekman. Estimated cost $225,000.

O., Cleveland—The Art & Bronze Co., 1782 East 37th St., awarded contract for the construction of a 2 story, 34 x 125 and 34 x 70 ft. foundry on East 43rd St. Estimated cost $50,000. Noted Sept. 23.

O., Cleveland—The Cleveland Heater Co., L. Freiedman, Pres., 1900 West 112th St., had plans prepared for the construction of a 1 story, 100 x 200 ft. addition to factory. Estimated cost $100,000. George S. Rider Co., Century Bldg., Archt.

O., Cleveland—The White Sewing Machine Co., E. S. Rodgers, Pres., Main and Elm St., awarded contract for rebuilding 3 story factory destroyed by fire. Estimated cost $40,000.

Okla., Oklahoma City—The Crane Co., 836 South Michigan Ave., Chicago, Ill., is having plans prepared for the construction of a 175 x 200 ft. pipe and machine shop here. Estimated cost $200,000. Private plans.

Okla., Wright City—Choctaw Lumber Co. awarded contract for the construction of a 60,000 1. capacity sawmill to replace fire loss. Estimated cost including machinery $40,000.

Pa., Beaver Falls—Standard Steel Specialty Co. awarded contract for the construction of a 1 story, 60 x 90 ft. addition to plant. Estimated cost $40,000. Noted Aug. 26.

Pa., Callery—National Metal Products Co., 1025 Chateau St., Pittsburgh, will build a 1 story, 60 x 170 ft. plant for the manufacture of spacing bars, channels, welding wire, etc., here. Estimated cost $40,000. Private plans.

Pa., Johnstown—Union Radiator Co., awarded contract for the construction of a 1 story, 83 x 124 ft. foundry. Estimated cost $40,000.

Pa., New Castle—National Radiator Co., Johnstown, awarded contract for the construction of a 1 story, 135 x 900 ft. addition to plant here. Estimated cost $150,000.

Pa., Poland—Shannopin Coal & Coke Co., 311 Ross St., Pittsburgh, awarded contract for the construction of a group of buildings including 1 and 2 story 43 x 60 and 52 x 151 ft. shops, etc. here. Estimated cost $100,000. Noted Oct. 7.

Pa., Rochester—Charles H. Haney Lumber Co. is having plans prepared for the construction of a 1 story, 120 x 150 ft. planing mill. Estimated cost $40,000. Private plans.

Wis., Cottage Grove—E. Whiting, is receiving bids for the construction of a 2 story 60 x 150 ft. sales and service station. Estimated cost $40,000. Private plans.

Wis., Janesville—Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, Mich., will soon award contract for the construction of a 1 story, 160 x 280 ft. addition to factory, here. A. Kahn, Marquette Bldg., Detroit, Mich., Archt.

Wis., Madison—Madison Overland Co., East Washington Ave., plans the construction of a garage. Estimated cost $150,000. Architect not selected.

Ont., Guelph—Guelph Stove Co., M. Kelley, Mgr., York Road, is having plans prepared for the construction of addition to factory. Estimated cost $165,000. Mahoney & Austin, Archts.